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The appeal of good food attractively served should never be underestimated. A bowl of brightly coloured fruit set on a snowy linen cloth among fine china, gleaming silverware, and crystal is a picture that delights the eye and stirs the appetite to a state of pleasurable anticipation. The bowl of fruit on this month's cover includes apples, pears, crabapples, persimmons, and red cayenne peppers. Photograph by Sparrow.

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SOIL TESTING in New Zealand and Overseas

By E. B. DAVIES,
Senior Principal Scientific Officer, Department of Agriculture's Rukuhia Soil Research Station

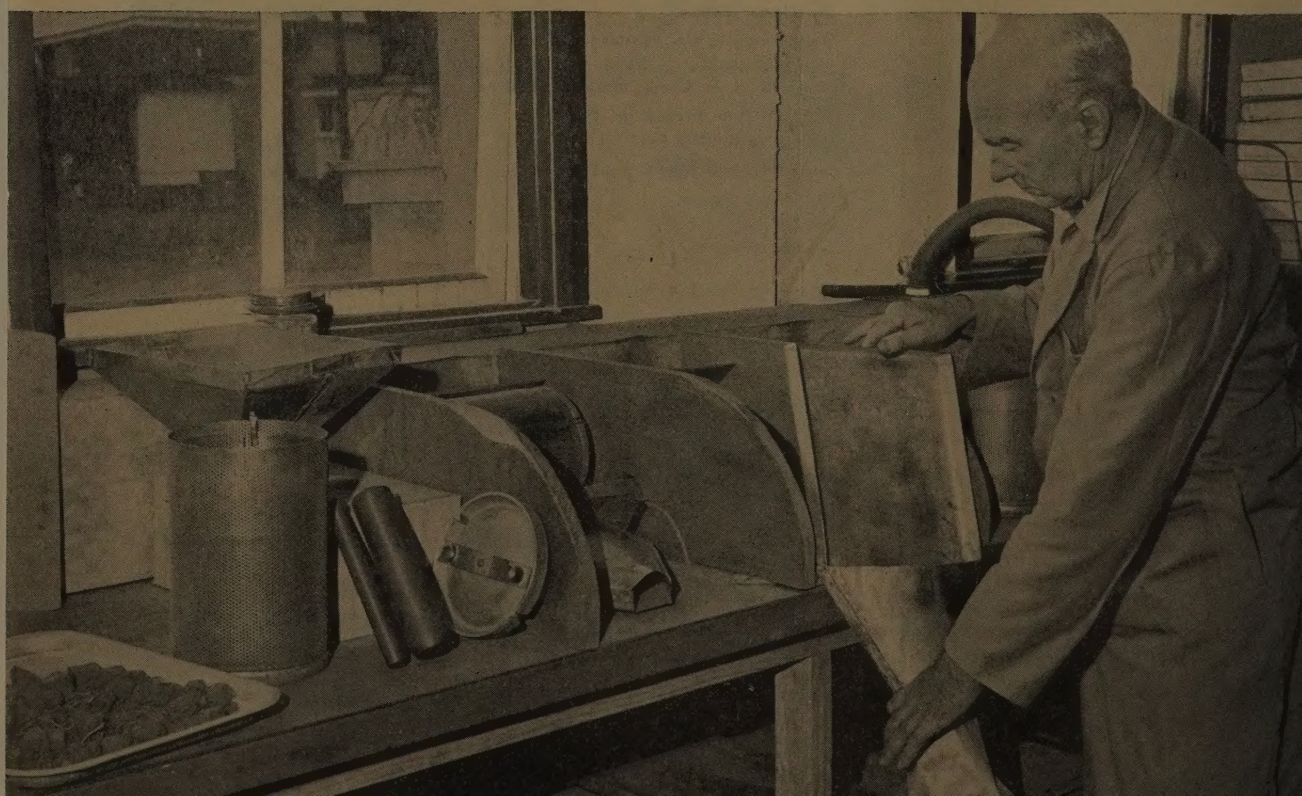
A RAPIDLY expanding world population demands food. A greater knowledge of the soil through pure and applied research has played, and is playing, no small part toward increasing production to meet this demand. Soil surveys and studies in soil chemistry and physics, in soil moisture relationships, and in microbiology all make their contribution. This article deals particularly with the organisation of soil testing in the immediate problems of determining fertiliser requirements, requirements which may vary from field to field of one farm.

THE well designed field experiment is the final reference in determining the fertiliser needs of a soil. However, there is need for a means of extending the knowledge gained from field trials to give a greater coverage. It is here that soil advisory tests have come into prominence, particularly, as would be expected, where population pressure is high and when development is such that advice can be implemented.

Soil testing in Europe and the British Isles is for the main part carried out in state-owned laboratories, and those attending the training course in Holland (see panel on opposite page) recommended that:

"The State should promote soil testing through its own laboratories or through those belonging to approved organizations. Soil testing as a private business is not regarded as desirable."

The position in our own country illustrates how a state organisation, in this instance the Extension Division of the Department of Agriculture, particularly lends itself to handling advisory soil tests. Some 120 field officers stationed at 45 centres through New Zealand are at the service of the farmer. They conduct their local fertiliser trials, becoming familiar with the soil's lime and fertiliser requirements. They also know the farms and farmers. They are well qualified both to take soil samples and interpret results to best advantage. Further, the Extension Division has well equipped



▼ Grinding soils preparatory to analysis. The dried soil cores (left) are placed in the perforated drum shown, the heavy metal bars are inserted, and the drum is rotated. As it turns the bars crush the soil until it passes through the perforations in the drum.

OEEC Soil-analysis Discussions

IN 1948 was founded the Organization for European Economic Co-operation (OEEC for short), the 17 member countries, extending from Norway to Turkey, pledging themselves among other things ". . . to join together to make the fullest collective use of their individual capacities and potentialities, to increase their production . . ." In 1954 the European Productivity Agency of OEEC, in view of the wide and growing use of soil testing, initiated a survey of the organisation and techniques of soil analysis in selected European centres, sending two experts, Dr Rice Williams (Britain) and Dr H. Riehm (West Germany) on tour to collect data and draw up a report. On their suggestion a 2 weeks' training course was subsequently held in Holland at which invited speakers dealt with various aspects of soil testing, problems were discussed, and certain centres were visited.

The proceedings and recommendations of this seminar and the report of Dr Williams and Dr Riehm have now been published by OEEC under the title "The Organization and Rationalization of Soil Analysis", several extracts from which appear in this article. Dr Davies has drawn on this book and on his own observations during a tour in Europe in 1954 in comparing the New Zealand advisory service with those in certain other countries. During the tour he was invited at one centre to join in discussion with Dr Williams and Dr Riehm. This article deals with organisation and general principles rather than technical details.

Apparatus used in phosphate determination. On the left 5 equal parts of phosphate extractant are being measured out simultaneously. On the right the completed extracts are being filtered 10 at a time.

laboratories to handle both advisory analyses and research toward improving methods. Provision is made for periodic discussion between field officers and specialist staff concerning the effectiveness of soil tests.

Britain and Eire

In England and Wales the National Agricultural Advisory Service operates through 12 centres spread over the country and staffed with specialists to deal with all problems concerned with agriculture. Each is equipped with its own laboratories and conducts its own field trials. Soil testing is one of the aids used in advisory work, over 100,000 tests being carried out annually. The various centres operate more or less independently, but are linked through administrative headquarters in London. The N.A.A.S. has the big advantage that soil, plant, and animal problems are all dealt with at each centre and an integrated approach is possible.

Advisory work in Scotland is handled by its three colleges of agriculture, that of the north of Scotland having the soil tests carried out by the well known Macaulay Institute for Soil Research.

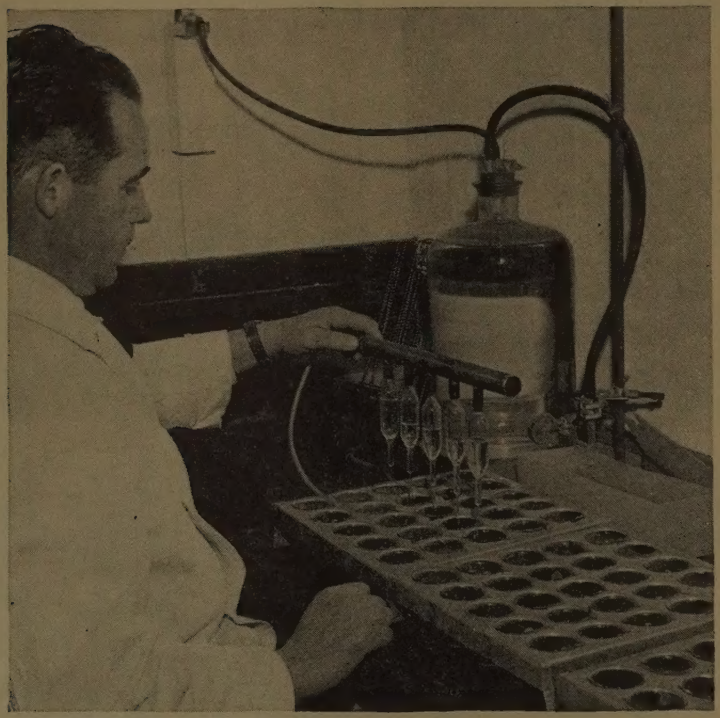
In Eire the position is much as in New Zealand, the advisory service being operated through the Department of Agriculture. Its research station at Johnstown Castle carries out soil tests and associated research work. Soil testing is on a much wider scale than in New Zealand, about five times the number of samples being handled a year.

European Countries

In Sweden, Denmark, Holland, and West Germany the intensity of soil testing is particularly high. Analyses are carried out in state institutions, except in Holland. Advisory work there is closely connected with three organisations:

1. The Government advisory service, whose officers make contact with the farmers, take samples, and advise farmers of results.
2. The Laboratory for Soil and Crop Testing, which carries out analyses of advisory samples and also routine analyses for the Government research stations. It also has an organised team of trained soil samplers found necessary to assist the Government advisory officers in coping with the demand.
3. The Agricultural Experimental Station and Institute for Soil Research at Groningen and the Central Institute for Agricultural Research at Wageningen, which are responsible for the research and field experiments on which the soil-testing methods and interpretation of results are based.

The Laboratory for Soil and Crop Testing was founded in 1927 as a



A multiple pipette speeds up the exact measurement of water for mixing with soils in soil analysis.

cooperative non-profit organisation, the property of the farmers' unions. Scientists working at the research stations were thus kept free of the onus of carrying out mass soil analyses.

The laboratory has expanded greatly and consists at present of a head laboratory at Oosterbeek with three branches in other parts of Holland. In 1953 it handled 113,602 soil samples and 33,276 crop samples. The total staff at that time was 247, not including the team of trained soil samplers. (Holland is roughly the size of Canterbury Province.) The laboratory is extremely well run and particular pains are taken to check the reproducibility of results between as well as within the four centres. The technical advisory committee of the laboratory consists of representatives of the various agricultural research institutions and the agricultural advisory service. This ensures close liaison between the three organisations associated with advisory work.

The New Zealand soil-testing service is small compared with large overseas concerns. A few figures giving the number of acres of land under cultivation or pasture per soil sample tested in a year illustrate the point:

	Acres per soil sample
Holland (1953)	48
*Eire	118
†U.S.A.:	
North Central ..	190
North Eastern ..	310
Southern	510
Western	2,080
New Zealand (1956) (improved land only)	1,780

* Estimate allowing 100,000 samples a year.

† J. W. Fitts and W. L. Nelson: "Advances in Agronomy", vol. 8, p. 244, Academic Press, New York (1956).

The disparity between the Dutch and New Zealand figures is paralleled by that between population densities; in Holland 180 persons per 100 acres of cultivated land against 11 per 100 acres of improved land in New Zealand. In a country such as Holland, which produces only 60 per cent of its food requirements, every effort has to be made to increase yields. Not only is the number of soil tests great, but also the background of trial data, allowing a surer interpretation of results. To quote from a pamphlet of the Laboratory for Soil and Crop Testing:

"The methods of soil testing applied at the laboratory have been checked for 20 to 30 years with the results obtained at thousands of experimental fields under a wide diversity of crops on all the types of soil occurring in this country and under very divergent conditions. Only due [to] this background of experience, gained from experimental fields of many years standing, has it been possible to render well founded advice."

Background Data

The essential need for background data is put cogently by Professor K. A. Bondorff, of Denmark:

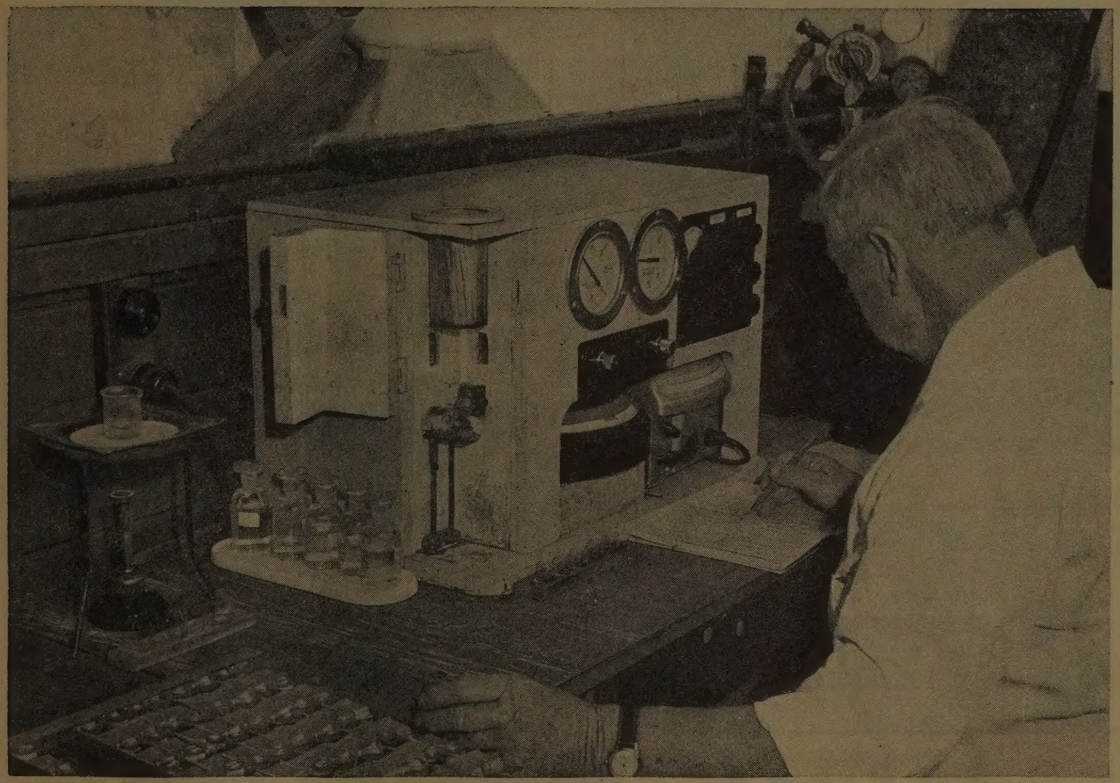
"The results of soil analyses, as found in the laboratories, are themselves without any value for the farmers. The reason is that the chemists—or the microbiologists—are only able to tell how much easily soluble phosphorus or potassium a given soil contains. But the farmer is not at all interested to know this. His interest is focused on the answer to quite another question: Will it pay to apply phosphate fertilisers or potash salt? And if the answer is yes, his next question inevitably is: How much? And no analysis is able to answer these questions.

> **"If the soil analyses shall be of any value to the farmer, it must be possible, based upon the analytical results, to answer the questions in which the farmer is interested. But this is only possible if a correlation between results of field experiments and the results of soil analyses from these experiments exists. It is the fundamental idea of soil analysis that such a correlation exists."**

Professor Bondorff explains how increases in yield of barley (grain) observed in the field from 100 and 200 kilograms per hectare of 40 per cent potash salt (equivalent roughly to 60 lb. and 120 lb. of muriate of potash per acre) tally fairly closely with those deduced from the soil "potash index". Such information is particularly important where livings have to be made from small holdings.

New Zealand

In New Zealand, lightly populated and with the emphasis on grassland farming, there is not the same pressure (though the high standard of living makes its demands) and the soil-testing service has not been developed to nearly the same stage. Work is still proceeding on the modification of tests to make them as widely applicable as possible to New Zealand's very varied soils. Only on certain Waikato dairy soils has an attempt been made to deduce from soil-test data the quantitative requirements for best results. Checks of soil tests against field crops are planned for the near future. The desirable application of phosphatic



Calcium and potassium are determined by a flame photometer. The extracts containing these two elements are atomised and passed into an oxy-acetylene flame. The atoms of the two elements emit characteristic radiations, which are separated to act on sensitive cells. The calcium and potassium concentrations are registered on the dials. The apparatus was designed and assembled at the Rukuhia Soil Research Station.

fertiliser is likely to be determined by the phosphate-fixing capacity of the soil as well as by the level shown by soil test. At present New Zealand soil tests for phosphorus or potassium endeavour to classify soils as responsive or non-responsive and to keep the indeterminate group between these two as small as possible.

It is important to decide on suitable methods of soil extraction early in the establishment of a soil advisory service. **The more thoroughly a test is correlated with trial data the less easy is it to change it, because a change means that the long process of checking against field results has to be recommenced.** The actual determination of the element concerned in the extract does not affect interpretation, and soil laboratories seize on every advance that makes for increased speed or accuracy.

Usual Determinations

In the OEEC report details of elements determined and laboratory methods are tabulated for 15 centres in England, Scotland, Ireland, France, Germany, Belgium, Holland, Denmark, and Sweden. The number of laboratories carrying out the various determinations as a routine and occasionally are listed separately below. The four laboratories under the Laboratory for Soil and Crop Testing, Holland, have been counted as one.

	All or most samples	As required
pH, phosphorus, potassium	15	—
Lime requirement	8	—
Calcium carbonate	6	1
Calcium	11	1
Loss on ignition	3	1
Carbon	2	2
Nitrogen	4	3
Magnesium	4	8
Sulphur	—	1
Manganese	2	4
Copper	—	2
Zinc	—	1
Boron	—	2
Molybdenum	—	—
Cobalt	—	3
Sodium	2	1
Aluminium	1	2
Iron	1	—
Mechanical analysis	3	—
Conductivity	1	2

All stations, as would be expected, examine the soils for pH, phosphorus, and potassium. Twelve of the 15 test further for magnesium, either as a routine or on request. Incidentally Dr Williams remarks: "In the future a greater need for the estimation for magnesium may arise. Is it possible that a good, quick, and accurate method for routine work will become available in the near future?" Such a test has recently been devised at the Rukuhia Soil Research Station laboratory, though the special equipment needed rather rules it out for small laboratories.

Of the trace elements only manganese (at two stations) and iron (at one) are determined as a routine. Several stations, however, determine one or more in special circumstances or on request.

Soil tests are charged for except in Great Britain and Eire. Trace elements are included in the price list (1953) for analyses in the Laboratory for Soil

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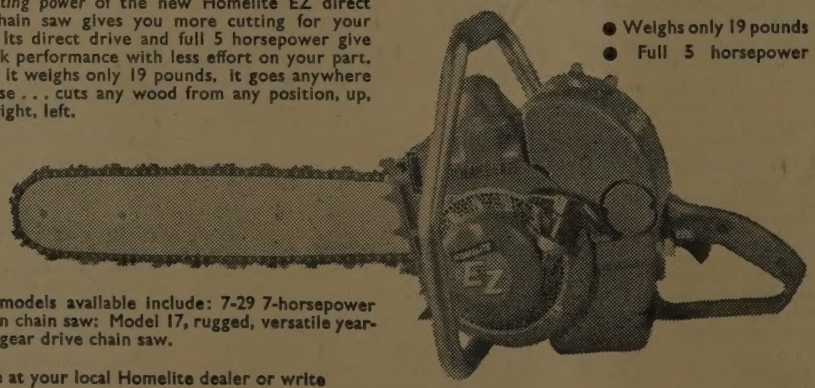

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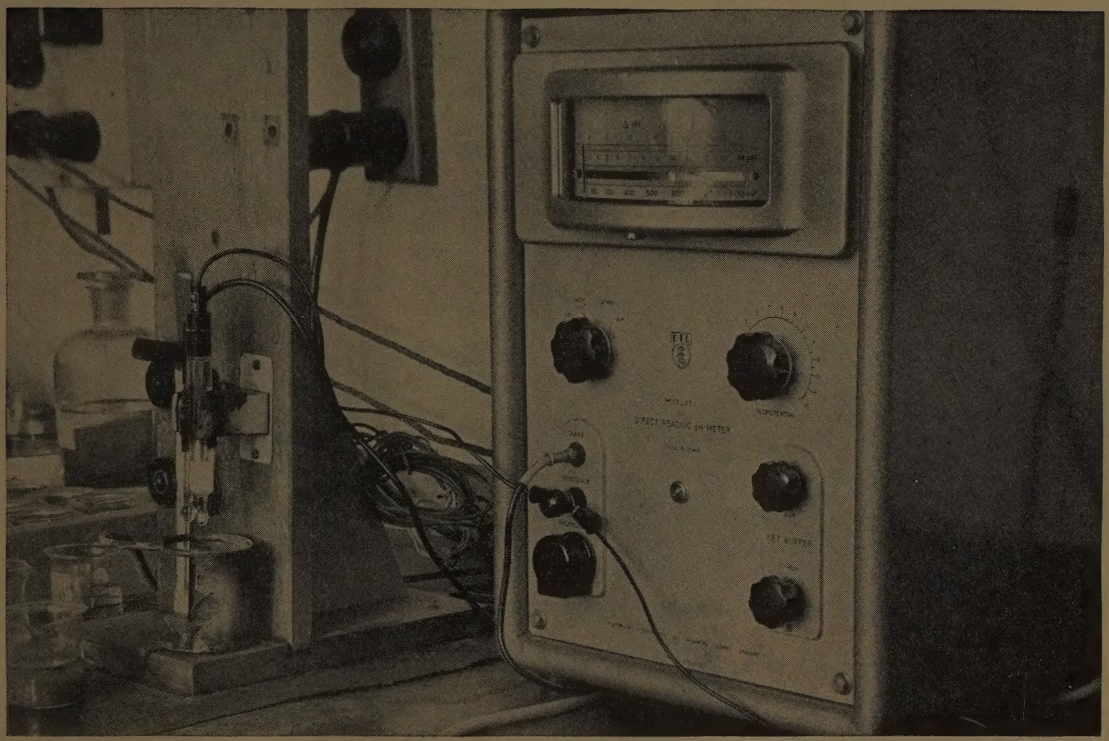


A meter which enables the pH (degree of acidity of a soil) to be determined electrically.

and Crop Testing (Holland), but it is stated that, with the exception of copper, the laboratory has no adequate basis for advice.

Trace Elements

The conclusions and recommendations about trace elements in the OEEC report mention a number of factors which are well known to anyone who has worked with them; for instance, that:

Information on soil, parent material, climate, drainage conditions, pH, and organic matter was regarded as very important in the study of trace element problems; that great care had to be taken that nothing in the composition of sampling tools, bags or boxes, sieving apparatus, etc., should contaminate the samples; that field experiments were needed to provide local information for interpretation of results; and that a highly trained staff and special departments were required for trace element work. The value of spectrographic methods and importance of interactions between trace elements were also mentioned.

For plant nutrition investigations the seminar considered soil testing the best method, whereas for animal nutrition studies both soil and plant analyses were desirable.

In New Zealand the dramatic effects of traces of cobalt on animal health, particularly on the volcanic soils of the North Island, the incidence of boron deficiency in fruit trees, brassica crops, and lucerne, and later the discovery of widespread molybdenum deficiency have together made the farmer trace element conscious. He looks for soil tests as a guide to the position on his own fields. Some private laboratories do supply advice as to trace element requirements based on such tests. **The Department of Agriculture will not do so until preliminary research has been carried out and results of suggested methods have been found to correlate favourably with field trial findings over a range of New Zealand soils.**

This immediately limits the possibilities. For such calibration against field responses a reasonable number of proven instances of deficiency are necessary. Boron, molybdenum, and cobalt deficiencies are widespread and copper responses are usual on peat soils and also occur on highly leached soils in the far north of New Zealand, but proven zinc and manganese shortages in crops and pasture are rare. The same applies to the major essential element magnesium.

Problems in Extending Soil Testing

There are further factors weighing against the operation of a comprehensive analytical service. The actual determinations for some elements do not lend themselves to mass-analysis procedures. For example, the more precise tests for boron require the use of concentrated sulphuric acid with special care to protect both analyst and apparatus. They are not rapid. Similarly, quantitative tests for molybdenum with removal of interfering substances take time. It will be realised that if at present 100 soils a day can be handled, the introduction of a test that can deal with only 10 soils a day will upset the whole flow. Either staff must be greatly expanded or the test restricted to limited areas.

Correct interpretation of results is vital. It is greatly complicated in some cases by interactions with other

elements; for example, molybdenum utilisation is affected by the pH and by phosphorus, sulphur, and manganese levels. A high pasture content of molybdenum is nearly always associated with a high soil test, but the converse does not hold. Very many high-molybdenum soils produce normal pasture. Other factors must influence uptake. Such complications, combined with the fact that the demand of advisory tests was monopolising the time of research staff, led to the withdrawal of the molybdenum test once available to farmers.

What is the position in other countries? The OEEC report states: "Much interest is being taken in the determination of micro-elements, as problems relating to a deficiency of one or other of these are continually cropping up in all countries. Boron is probably the one most investigated. . . . Several laboratories are working on manganese, copper, molybdenum, and cobalt and tentative methods have been developed for their determination in special problem soils. At Aberdeen (the Macaulay Institute) several elements are estimated by means of a spectrograph. In the Netherlands they are actively engaged in studying problems in connection with trace elements, and it is hoped that a good method for available soil copper may soon be evolved."

It is obvious that no basis for a general trace element service had at that time (1955) been established.

A soil test may be considered in two stages: (1) The extraction in which some reasonably available fraction of the total amount present in the soil is separated. (2) The determination of the element in the extract. The spectrograph may speed up the determination of trace elements. The problem of a suitable extractant is another matter, but some success has been obtained elsewhere in the cases of boron and of cobalt. Their determination, however, is not rapid. In New Zealand, areas affected by boron deficiency are fairly well known through the visual symptoms in crops (for example, mottle heart in swedes), and the Animal Research Division conducts a diagnostic service for cobalt deficiency based on liver analysis.

Development of Tests

Present efforts at the Rukuhia Soil Research laboratory are directed toward improvement in the tests for potassium and phosphate, development of one for sulphur, and investigation of the interactions which affect interpretation of molybdenum analyses. Resources can thus be directed to the maximum benefit of the farmer. Meanwhile the Extension Division has field trials ranging from over 800 with molybdenum down to 280 with copper and 180 with boron, zinc, and vanadium.

Results from these trials at present provide the soundest information from which the needs for trace elements can be judged. They also provide a basis for the checking of possible chemical tests for the trace element status of soils.

Cocksfoot Stook Lifter

IN the harvesting of cocksfoot seed, stooks are normally forked into a trailer for transfer to the mill stationed in the middle of the paddock. Two men are usually needed to fork the sheaves and a considerable quantity of seed is usually lost by shaking.

Two Mid-Canterbury farmers, Mr G. E. Moore and his father Mr G. E. Moore, have developed a machine to lift a whole stook into the trailer. Based on a front-end loader with the bucket replaced by two swivelled dump rakes, the machine has had a season's use. It has been found that one man and this tractor-mounted lifter can move many more stooks than two men working hard in heavy stubble. A considerable quantity of seed is saved, as little is lost by the mechanical transfer compared with the wastage in manhandling stooks.

The trailers have been replaced by sledges to take larger loads (up to 60 stooks).

—E. DELAHUNTY,
Instructor in Agriculture,
Department of Agriculture,
Ashburton

Aerial Topdressing Costs

By R. H. SCOTT,
Land Utilisation Officer, Department of Agriculture, Wellington

IN 1953 some cost data on aerial topdressing were obtained from farmers on the east coast and in the Taranaki and Manawatu districts, the information being published in the "Journal" of March 1954. Last year it was decided to bring the cost information up-to-date and also to obtain data from other districts. The results of this investigation are given in this article.

AGRICULTURAL aviation has developed into big business in the Dominion. Aircraft are spreading over 400,000 tons of fertiliser a year, in addition to which there is spraying of crops and pastures, supply dropping in hill country, and the dropping of poison to destroy rabbits. To do this work there are about 300 aircraft, and the investment in the machines and ancillary equipment is estimated at £1.25 million. The farmer has also made a large investment to enable aircraft to assist him, and a conservative estimate of the capital cost of farm airstrips is £1.5 million.

Costs for aerial work are thus inevitably quite high, and it is in costs that the farmer is interested, and will be more so with any fall in the price of his produce.

Cost data were obtained from farmers in most districts, and for convenience seven major areas were defined: North Auckland, Waikato-Bay of Plenty-King Country, Taranaki-Rangitikei-Wellington, Gisborne-Hawke's Bay-Wairarapa, Nelson, Canterbury, and Otago-Southland.

Cost of Constructing Airstrips

The costs for constructing airstrips include those for bulldozing and grading the site, construction of access tracks, cultivation to sow down the strip, fertiliser and seed, and in some cases drainage and fencing as well as the cost of bulk bins and storage sheds. Since the last survey many more storage sheds have been built on airstrips. The major cost item was that of bulldozing and grading the site, which in most cases accounted for 60 to 70 per cent of total costs.

Table 1 sets out the percentage of strips in the different districts which fall within definite cost ranges. This method of setting out the costs was done in preference to computing an average cost for a district, which could have been influenced upward by a few strips of very high cost.

The majority of airstrips appear to cost less than £500, and except for Canterbury, Otago, and Southland the

TABLE 1—COST OF AIRSTRIPS

	Percentage of cases falling within cost ranges				
	Under £250	£250 and under £500	£500 and under £750	£750 and under £1,000	Over £1,000
North Auckland	33	44	12	—	11
Waikato-King Country-Bay of Plenty	23	32	18	9	18
Gisborne-Hawke's Bay-Wairarapa	35	35	18	12	—
Taranaki-Rangitikei-Wellington	23	31	8	23	15
Nelson	25	50	25	—	—
Canterbury	77	—	23	—	—
Otago-Southland	66	32	1	—	1

most common cost range is £250 to £500. In Canterbury of those farmers included in the survey no less than 40 per cent had incurred no cost on airstrip construction, as they were able to use an existing paddock, and in Otago and Southland 75 per cent of those in the survey used a paddock.

Cost of Spreading Fertiliser

The most common rate of application of superphosphate was 2 cwt. per acre, as is shown in Table 2.

TABLE 2—RATES OF AERIAL APPLICATION OF SUPERPHOSPHATE

Rate of application cwt. per acre	Percentage of farmers
1	9
1.5	11
2	54
2.5	9
3	11
3.5	6
	100

Data were collected on the cost to farmers of spreading fertiliser on a block or blocks during the 1956-57 season. It appears that to the majority of farmers in the survey costs to spread 2 cwt. per acre were between £1 10s. and £1 15s. per acre. These were all-in costs, inclusive of cost of fertiliser, spreading by aircraft, etc.

TABLE 3—COST OF SUPERPHOSPHATE AND AERIAL SPREADING AT 2 CWT. PER ACRE

Cost per acre shillings	Percentage of farmers
20 and under 25	2
25 and under 30	25
30 and under 35	35
35 and under 40	25
40 and under 45	11
Over 45	2
	100

Except in the Nelson district there was not much variation between districts. For Nelson the costs were higher because of the higher transport costs of getting the fertiliser to the airstrips. Much of the fertiliser used there is railed from Christchurch to Blenheim and then transported by road to the Nelson and Golden Bay areas. In parts of Canterbury it is quite common for superphosphate to be taken direct from the works to the airstrip, and this accounts for the low cost for railage as shown in Table 4.

In Table 4 adjustments were made in the cost of fertiliser. The prices used were those operating since July 1957 for superphosphate supplied in containers to users. Also the figure for the Taranaki-Rangitikei-Wellington district was adjusted to allow for the differing prices operating at the New Plymouth and Wanganui works.

TABLE 4—AVERAGE COST OF AERIAL SPREADING OF SUPERPHOSPHATE AT 2 CWT. PER ACRE

Cost components	Waikato-Bay of Plenty-King Country	Gisborne-Hawke's Bay-Wairarapa	Taranaki-Rangitikei-Wellington	Nelson	Canterbury	Otago-Southland
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Fertiliser ex works	19 10	1 0 11	1 0 10	1 0 4	1 0 4	19 10
Railage on fertiliser	3 11	2 7	3 9	5 5	7	5 1
Cartage to airstrip	3 4	3 6	1 1	5 11	3 4	2 4
Aerial spreading by aircraft	6 6	6 0	6 0	7 7	7 7	7 1
Interest on capital investment in airstrip	7	9	1 3	1 6	7	3
*Other	3	6	9	2 4	4	3
Total cost	1 14 5	1 14 3	1 13 8	2 3 1	1 12 9	1 14 10

* Includes such costs as annual maintenance of airstrip and cost of labour provided by farmers to assist with aerial topdressing.

TABLE 5—AVERAGE COST OF AERIAL SPREADING OF SUPERPHOSPHATE

Cost components	North Auckland 3 cwt. per acre	Canterbury 1 cwt. per acre
	£ s. d.	s. d.
Fertiliser ex works	1 9 9	10 2
Railage on fertiliser	3 1	1 7
Cartage to airstrip	2 10	1 1
Aerial spreading by aircraft	9 10	4 9
Interest on capital investment in airstrip	11	1
Other	9	1
Total cost	2 7 2	17 9

Some farmers' costs were different from the figures shown owing to granulated superphosphate being used or to superphosphate being supplied in bulk.

In Canterbury over 50 per cent of the farmers in the survey applied 1 cwt. of fertiliser per acre, while in North Auckland most farmers applied 3 cwt. or over per acre. Table 5 shows the costs in these districts to apply those quantities.

Types of Aircraft

The farmers in the survey had their work done by both small and medium-class aircraft, that is, those with loads of 5 cwt. to about 20 cwt. The difference in cost to the farmers with these different aircraft was very small.

Rent of Airstrips

The usual charge for farmers who did not have their own airstrips and used that of another farmer was based at 5s. per ton flown from the strip. Charges ranged from 2s. 6d. to 10s. per ton. Of those paying a rent charge 45 per cent paid 5s. per ton, 25 per cent 2s. 6d. per ton, and the balance charges at 3s., 4s., 6s., and 10s. per ton.

Photograph by National Publicity.

"Breeding Better Cows": Craig Wheaton-Smith

MR CRAIG WHEATON-SMITH has attempted to place cattle breeding in both its historical and scientific perspective and to explain the mechanisms of heredity. The author is himself a British breeder and his book has been written not for students, but specially for British farmers and breeders.

The book provides first a quite interesting review of the history of the main British breeds and of the Breed Societies, next an introduction to the science of genetics which farmer readers may find rather difficult, and finally deals with practical aspects of dairy cattle breeding and its problems.

Mr Wheaton-Smith is obviously a real enthusiast. He has little time for fancy points and a great deal of respect for progeny testing. He is rather scathing about the artificial breeding service provided in Britain, though he realises that artificial breeding can be valuable as a tool in dairy cattle improvement. He has a jaunty style of writing, but his book is written against a British background and for this reason will be less useful to New Zealand than to English farmers.

—*L.R.W.*

Dairy Farmer (Books), Ipswich, England, 1957. 20s. 6d.

FARMING IN NEW ZEALAND

PREVIOUS sections of this article by A. C. Burgess, Instructor in Agriculture, Department of Agriculture, New Plymouth, about farming in Taranaki have dealt with early settlement of the province, the rise of the dairy industry, and the development of sheep farming. The article is concluded in this issue with a study of the methods used to improve a Taranaki dairy farm over the last 20 years.

IN the early part of this century when fertility was falling weeds such as ragwort, blackberry, gorse, and bracken fern became very troublesome on much of the dairying land in Taranaki, particularly in North and Central Taranaki. Where there was much timber still on the land or where the farms were broken by creeks the weed problem was serious. Though this deterioration was arrested on much of the country, and Taranaki dairying lands by 1938-39 had reached a high level of production, there were many farms which had been allowed to go back during the depression and which were still at that time practically all blackberry and other weeds and producing very little butterfat. Such a farm was taken over by Mr D. W. Rowan on the King Road, Inglewood, in August 1938.

The farm of 113 acres is of the soil type known as Inglewood coarse, sandy loam, a soil formed from ash from the Stratford shower, which was the later of the main eruptions from Mt. Egmont. The front of the farm is steeply rolling hills, with some fairly flat areas toward the back.

Typical of many North and Central Taranaki farms at that time, it was a maze of winding creeks infested with blackberry and bracken fern, in many places impassable to stock. There were only 5 paddocks on the farm and to get from the shed to the back of the farm the cows had to wander down a deeply rutted track, often up to their bellies in mud, and across a deep gully near the side boundary. When they crossed this they had the run of the whole of the back of the farm.

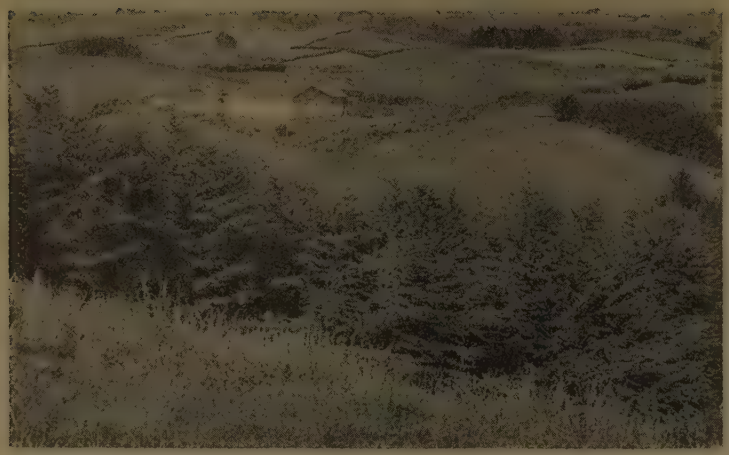
The only buildings on the farm were a small whare and a cowshed. The farm was bought as a going concern and carried 32 cows and 1 horse. The first year Mr Rowan milked the cows on his father's farm and used his new farm only for dry stock.

Development of the Farm

Mr Rowan realised as soon as he took over the farm that he would have to plough it all and sow it in new grass. He adopted a plan that he continued to follow until the development of the farm was well advanced—plough in early spring and sow a crop of swedes, plough again the following spring and sow maize, millet, or oats, and plough again in autumn and sow in permanent pasture. Oats have been preferred for the second crop in recent years and in most cases have been cut for hay.

On some of the steeper paddocks of the farm the area was ploughed three times in the one year, in May, September, and January, without any crop being sown. After the third plough-

HEADING PHOTOGRAPH: To obtain a better layout of his farm Mr Rowan has cut down trees which he had planted in some gullies and has filled in the gullies.



The homestead on Mr Rowan's farm at Inglewood. The rolling country is typical of farm land in the district.

ing the area would be worked up and sown in grass.

Mr Rowan is convinced that the three ploughings are necessary to control blackberry when it is well established, as it was on his farm. Naturally he could plough only a few acres each year and his aim has been to plough and crop up to 7 acres a year. To get the best out of what was still in poor grass and blackberry he cut the blackberry with a scythe or mower and applied what topdressing he could afford.

A policy which Mr Rowan adopted from the beginning of development of the farm was to make a really good job of each paddock as he did it rather than to concentrate only on the easily ploughable parts of a paddock.

First the swampy creeks were drained about 12 months before the first ploughing, the drain being left open. Three or 4 in. tiles were then laid, the drain was filled in, and the creek banks were ploughed and scooped down until the paddock was as nearly level as possible. Often there were as many as five of these creeks in a paddock of 6 to 7 acres, so the extent of the job which Mr Rowan has so successfully accomplished can well be appreciated.

In recent years the work which he had to do with horses and scoop and heavy manual labour has been done by a contractor with a bulldozer, and the transformation in some of the very broken areas of the farm has been remarkable.

Mr Rowan would advise any young farmer taking over broken land to make every effort to get small creeks worked down so that paddocks are level enough to go over with a tractor and implements. Though this is often not possible, it is surprising how even a few hours' work with a bulldozer will often change a paddock. The cost of doing such work frequently deters farmers from attempting it, but the results are really worth while. Rough creek banks are a haven for blackberry and other weeds which require considerable time, effort, and expense to keep in check. Once the creeks are filled in, tractor-drawn implements can be used easily on paddocks which are otherwise impossible to work properly. Moreover the filling in of creeks gains good grazing land.

Cropping

Swedes and chou moellier used to be grown every year for winter feed, but the incidence of bacterial rots has caused Mr Rowan to discontinue winter cropping. He still sows 3 to 5 acres of soft turnips or soft turnips and chou moellier for later summer and early autumn feed. Though really dry summers are seldom experienced in the district, the spell given to pastures while the crop is being fed allows grass to be saved for later in autumn and thus makes it possible to shut up more grass for spring feed.

Grassing Down

Grass seed at the rate of 50 to 60 lb. per acre used to be sown, usually about mid-March, the mixture being as follows:

	lb.
Certified perennial ryegrass ..	20
Italian ryegrass	10
Certified cocksfoot	10
Certified white clover	1
Cowgrass	2
Timothy	8
Crested dogstail	2
Subterranean clover	1
	54

In the last 3 to 4 years the grass-seed mixture has been modified. Short-rotation ryegrass has replaced Italian ryegrass, cocksfoot has been reduced from 10 lb. to 6 lb., timothy has been reduced from 8 lb. to 4 lb., white clover has been increased to 2 lb., and the crested dogstail has been left out entirely. The most recent mixture sown was:

	lb.
Certified perennial ryegrass ..	15
Short-rotation ryegrass ..	15
Certified cocksfoot	6
Timothy	4
Cowgrass	2
White clover	2
	44

Mr Rowan considers that one of the main reasons for the reduced sowing giving even better results than earlier heavy sowings is the increased use of the Cambridge roller for consolidation. Earlier, before a roller was used, difficulty was experienced in getting good consolidation for grass. Extra working with discs and harrows was necessary to get anything like a satisfactory seedbed. The seed was harrowed in after sowing. Since the roller has been used the ground has been rolled on the furrow and rolled before the seed is sown and rolled again after. The seed is not harrowed in. Mr Rowan claims that since he has used this method his strikes of grass have been much better than he had before.

Importance of Fertiliser

Ample fertiliser, too, has played an important part in getting a good establishment of young pastures. Mr Rowan has placed a lot of faith in basic slag when it has been available and also has used a phosphate-potash-lime mixture in most years. Lately more potash has been included in the mixtures, the aim being to apply about 4 cwt. of phosphate and 1 cwt. of potash when the grass is sown.

On established pastures 4 cwt. of basic slag and 1 cwt. of potash are applied in autumn and 4 cwt. of superphosphate and 1 cwt. of potash in spring. Though lime does not appear to give a response on this soil type, Mr Rowan has used lime in the past, generally at the rate of 4 or 5 cwt. per acre each year. He has not ap-

plied any for the past 2 or 3 seasons but intends to apply 40 tons again this year.

In addition the manure from the cowshed and piggery has been collected in a sump and is regularly spread over the pastures. It has been used to great advantage on the bulldozed areas in paddocks recently levelled and sown. Where there is much subsoil exposed the grass takes some time to establish well because of lack of humus and low nitrogen, and the sump manure is very valuable in such places.

Value of Good Layout

This topdressing is reflected on all parts of the farm in vigorous, healthy pastures, the quality of which has resulted mainly from the good pasture management adopted, but this has been made possible only by the good layout which Mr Rowan has developed. On this type of country, which is by no means flat and which is much broken by creeks, a systematic layout is often looked on as almost impossible and difficult working of the farm is accepted as inevitable.

The first step in developing the present layout was to make a good crossing over the deep gully dividing the front from the back of the farm at a point straight back from the shed and to make a concrete race off which 4 paddocks open directly. Three more can be reached through paddocks leading off this race. Forward of the shed 2 front paddocks open off the race and the road is used to get into 2 more. This arrangement still left one side of the farm not served by a race and so a few years ago Mr Rowan constructed a new concrete race from the shed and almost at right angles to the first and this when completed will serve another 5 or 6 paddocks.

On most farms a layout is final once it has been established, especially if any of the paddocks have hedges round them, but here again a broad and progressive outlook has been shown. Mr Rowan realised that the first race he made would serve his requirements better if it went further down toward the back of the farm and if the paddocks opened directly off it, thus avoiding the necessity of the cows going through paddocks to get to others. This work has been completed and though it entailed shifting fences and removing live shelter belts, it was considered to be worth while in the long run.

Shelter Belts and Hedges

Though the smaller creeks were filled in wherever possible, the larger gullies and creek beds were planted with pines, macrocarpas, or lawsonianas. Barberry hedges have been planted along fence lines in all paddocks, so that shelter of the farm is very good. In fact Mr Rowan now considers that perhaps too much planting of tall shelter trees has been done in some places and he has taken out some of the trees planted in gullies and has had the gullies filled in. However, there is no doubt that the trees planted have played an important part in getting high production from pastures and stock.

The farm is well provided with trees and hedges. Most of the fence lines have been planted with barberry hedges.

In the development stage of the farm the policy of tree and hedge planting was to plant about 3,000 3-year-old barberry plants along fence lines and about 300 macrocarpa, lawsoniana, or pine trees along gullies each year.

Pasture Management

The pasture management practised is that which is generally recognised to give the best results. In autumn paddocks are shut up for spring feed for the milking herd. The first paddocks are shut in early April and then as the dry cows eat a paddock out it is harrowed and shut. There is good feed on at least half of the farm when the cows come in in spring. This autumn-saved pasture is fed off in spring with an electric fence. Silage is fed with the saved grass and is fed out on the area grazed the previous day.

The electric fence is used well into spring. Especially when there is danger of bloat Mr Rowan changes the cows on to a new break about midday so that they do not go on to fresh grass straight after milking. He claims that this is a valuable aid in checking bloat. From late spring until the end of the season the electric fence is not used, but the cows have a new paddock each day. No special night paddocks are used.

All paddocks are harrowed at least once in spring after being fed off with the electric fence and harrowed again in autumn or early winter before being closed for spring feed.

Generally topping in late spring is not done, but light cuts of hay are taken off some paddocks which are getting away from the cows.

Hay and Silage

Of the 113 acres on the farm from 45 to 50 acres a year are now cut for

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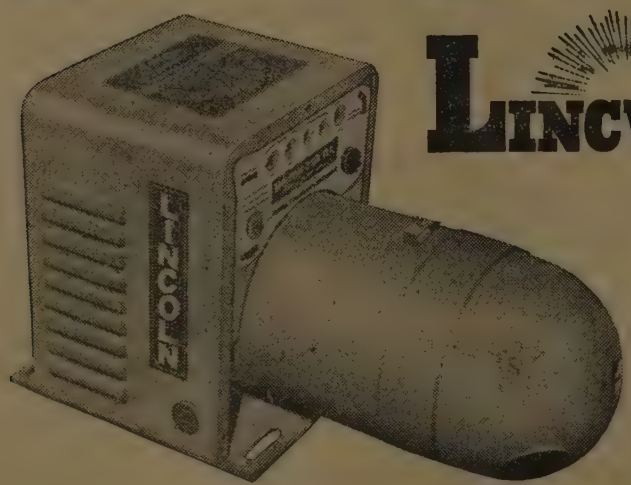

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hay or silage. Until recently more silage than hay was made, but as Mr Rowan now owns his own baler, he has made more hay. Often he cuts paddocks which may have been shut up for only a few weeks and the hay is therefore of very high quality.

Weed Control

Weeds are a problem on this farm as on most dairy farms in Taranaki. Blackberry is now well under control, but weeds such as Californian thistle, docks, and giant buttercup have now become really troublesome. Spraying with MCPA to control buttercup and with 2,4-D to control docks and Californian thistle is likely to become a regular practice on this farm for a few seasons until these weeds are under control.

The method of applying MCPA for best results on giant buttercup seems to be to spray with 2 lb. acid equivalent per acre in early autumn to control mature plants and to follow up in spring with 1 lb. acid equivalent on the seedling plants.

For dock control amine 2,4-D has given good results on the broad leaf dock, which is the commonest one on most Taranaki dairy farms. This material has been sprayed on at the rate of 2 lb. acid equivalent per acre in spring or early summer.

The result of spraying Californian thistles with weedkillers has not generally been good. A plant with such an extensive root system needs a follow-up spraying for perhaps 2 seasons after the initial spraying. The farmer has been using MCPA at 1½ lb. acid equivalent per acre applied when the plant is in the bud stage of growth, that is, just before flowering.

[Better results and less clover damage have been achieved on docks, thistles, and buttercups by use of 2,4-DB and MCPB at rates of 1 to 1½ lb. acid equivalent per acre. Mature docks are not effectively controlled, but seedling docks and young regrowth docks are satisfactorily controlled. Californian thistles should be treated in the young rosette stage. MCPB has given adequate control of giant buttercup.—*L. J. Matthews, Weeds Research Officer, Department of Agriculture, Wellington.*]

Pig Management

A good pig layout which Mr Rowan built several seasons ago has enabled available skim milk to be used to advantage. The combined farrowing and fattening house with 6 units has the skim milk pumped from the cowshed into a storage tank and piped to each unit. Water is laid on from the high-pressure pump and enables the piggery to be easily and efficiently cleaned.

Up to 1955-56 5 sows were kept and the spring litters, farrowed in May, June, and July, have been sold as baconers, and the autumn litters, farrowed in November, December, and January, have been sold as porkers. In the 1956-57 season 9 sows were run and the management was similar except that 20 piglets from the spring farrowing litters were sold as weaners.

The breeding is from Large Black sows mated to a Wessex Saddleback boar. This cross is a very good one and pigs of good conformation are bred. Pigs from a Wessex Saddleback sow and a Large White or Large Black boar might be even more satisfactory, because the Saddleback is said to be a very good mother.

Sows are grazed on cow paddocks until 3 to 4 weeks before farrowing, when they are brought in and fed skim milk and meal. Some of the sows are farrowed in the large house and some in detached units nearby. After farrowing sows are fed on skim milk and meal (consisting of meat meal and pollard). When the litter is about 7 to 10 days old dry meal is fed in a creep.

Fattening is done entirely inside except that the pigs are let out into the grass pens in front of the pig house for occasional exercise.

A TARANAKI DAIRY FARM

Deep gullies running down from Mt. Egmont make many Taranaki farms difficult to work, but many of these gullies can be used to grow timber, as was done in the early stages of development of Mr Rowan's farm.

Stock-carrying Capacity and Production

When the farm was bought in 1938 32 cows and 1 horse were on the property. The numbers of stock carried in the 1956-57 season were 65 cows, 11 calves, 2 horses, 11 heifers, 2 bulls, and 55 sheep.

Butterfat production in 1938-39 was 71 lb. per acre, but since 1941-42 has been as follows:

Season	Cows milked	Butterfat per acre
1941-42	49	119
1942-43	50	121
1943-44	50	118
1944-45	51	138
1945-46	52	131
1946-47	50	126
1947-48	53	153
1948-49	51	154
1949-50	53	150
1950-51	60	178
1951-52	61	169
1952-53	63	188
1953-54	63	182
1954-55	57	163
1955-56	58	164

The butterfat production that has been attained is quite good, but is by

(Continued on page 536)

Radio Broadcasts for Farmers

RADIO broadcasts for farmers during July are as follows:

1YA Auckland, 7.45 p.m.

2 July—Talk by officer of Animal Industry Division, Department of Agriculture, Auckland.

9 July—"Nitrogen Topdressing", by C. M. Blick, Fields Instructor, Department of Agriculture, Warkworth.

16 July—Talk by officer of Animal Industry Division, Department of Agriculture, Auckland.

23 July—"Spring Pasture Management", by J. D. J. Scott, Instructor in Agriculture, Department of Agriculture's Ruakura Animal Research Station.

30 July—Talk by officer of Animal Industry Division, Department of Agriculture, Auckland.

1XH Hamilton, 12.33 p.m.

14 July—"Lambing Troubles", by D. Bilkey, Livestock Instructor, Department of Agriculture, Hamilton.

21 July—"The Economics of Spring Butterfat Production", by J. M. Miller, Agricultural Economist, Department of Agriculture, Hamilton.

28 July—"The Future of Dairy Farming", by R. Woolerton, Federated Farmers, Hamilton.

1YZ Rotorua, 7.15 p.m.

9 July—"Lucerne Establishment, Utilisation, and Topdressing", by R. W. Moody, Instructor in Agriculture, Department of Agriculture, Rotorua.

23 July—"Incidence of Feed Flavours, 1957-58", by G. Purvis, Superintendent of Butter Instruction, Department of Agriculture, Rotorua.

2XG Gisborne, 8 p.m.

8 July—Talk by J. D. Overbye, Horticultural Instructor, Department of Agriculture, Gisborne.

22 July—Talk by E. B. Smythe, Livestock Instructor, Department of Agriculture, Gisborne.

2XA Wanganui, 8 p.m.

3 July—"Canadian Newsletter", by Mary MacDonald.

10 July—"The Radio Vet.", by S. Jamieson, Veterinarian, Department of Agriculture, Wanganui.

17 July—Talk by C. M. Bailey, Supervisor, Taranaki District Pig Council.

24 July—"Management in the Brooder House", by B. J. Russell, Poultry Instructor, Department of Agriculture, Wanganui.

31 July—"Ram Selection", by P. C. Marshall, Sheep and Wool Instructor, Department of Agriculture, Wanganui.

3YA Christchurch, 12.20 p.m.

7 July—"The Farming Potential of South Westland", by R. C. Stuart, Agricultural Economist, Department of Agriculture, Christchurch.

21 July—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

4YA Dunedin and 4YZ Invercargill, 12.33 p.m.

7 July—"Dalapon", by J. R. Thomson, Instructor in Agriculture, Department of Agriculture, Invercargill.

14 July—"Short-rotation Ryegrass", by W. A. Lunn, Fields Instructor, Department of Agriculture, Ranfurly.

21 July—"Cropping", by A. R. Rankin, Fields Instructor, Department of Agriculture, Invercargill.

28 July—"Care of Chickens", by J. H. Warwick, Poultry Instructor, Department of Agriculture, Oamaru.

Regular Sessions

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8 p.m. (Northland livestock report and "Farming for Profit"), Wednesdays at 8 p.m. ("Farming for Profit"), and Fridays at 8 p.m.

1YA Auckland, Mondays at 12.33 p.m., Tuesdays, Wednesdays, and Thursdays at 7.45 p.m., and Fridays at 6 p.m. and 7.45 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month at 12.33 p.m.), Thursdays at 12.33 p.m.

2XA Wanganui, Wednesdays at 8 p.m. (stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawke's Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawke's Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Mondays and Thursdays at 12.33 p.m.

4YA Dunedin, Mondays at 12.33 p.m., Tuesdays at 12.33 p.m., Wednesdays at 12.33 p.m. and 6.50 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 12.33 p.m. and 7.15 p.m. (Lorneville and Gore stock market reports), Wednesdays at 12.33 p.m., Thursdays at 12.33 p.m.

A Taranaki Dairy Farm

(Continued from page 535)

no means outstanding. However, all work on the farm except bulldozing of creeks, has been done by the farmer and his wife and all the development has been financed out of revenue.

Pigs have provided extra revenue and during the past 3 seasons Mr Rowan has done contract hay baling. The sidelines have doubtlessly kept down the number of cows milked, but have provided capital for further development.

Mr Rowan is satisfied with the policy which he has adopted and within the next 5 to 10 years the herd will be increased and production could reach 220 to 260 lb. of butterfat per acre. To have developed from almost a wilderness with hardly a building on it an attractive farm of 113 acres with a comfortable home, a modern cowshed, piggery, two implement sheds, and two haysheds and with a tractor, hay baler, and a full range of farm implements is a very satisfactory achievement, especially when it has been done with little outside physical or financial assistance.

Meteorological Records for April

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in Inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	59.2	— 1.9	81.6	38.2	0.60	8	— 5.00	0.23	26	189
Auckland	160	60.2	— 1.1	74.7	44.9	1.33	13	— 3.06	0.71	25	189
Tauranga	10	56.9	— 1.6	74.0	35.7	0.38	3	— 4.64	0.25	25	236
Ruakura	131	54.0	— 2.6	75.5	32.8	1.65	15	— 2.09	0.81	25	189
Whakarewarewa ..	1006	53.3	— 1.7	75.3	33.9	0.80	6	— 4.01	0.63	25	205
Gisborne	14	57.4	— 0.5	81.0	35.0	0.33	6	— 3.33	0.11	18	228
New Plymouth ..	160	56.0	— 2.1	72.4	37.0	3.00	13	— 1.78	0.46	21	173
Kariol	2125	47.8	— 2.6	70.0	30.0	3.88	18	+ 0.06	0.74	25	
Napier	5	58.0	— 0.5	84.0	38.2	0.20	4	— 2.43	0.15	28	236
Wanganui	72	55.2	— 2.3	72.0	40.3	2.69	13	— 0.11	0.56	28	181
Palmerston North ..	110	53.8	— 2.8	71.5	34.2	2.82	13	— 0.54	0.94	25	160
Waingawa	340	52.6	— 1.9	75.0	32.0	2.20	15	— 0.70	0.61	18	198
Wellington	415	54.8	— 1.3	72.3	38.8	1.81	9	— 2.00	0.77	18	204
Nelson airfield ..	5	53.2	— 0.9	75.9	31.9	0.96	7	— 1.99	0.34	25	221
Blenheim	12	53.9	— 1.6	79.9	28.4	1.03	9	— 1.91	0.26	18	238
Hokitika	15	50.6	— 2.3	65.0	32.4	11.39	18	+ 2.56	1.86	3	135
Hanmer	1270	49.6	— 1.9	75.0	28.0	3.48	11	+ 0.14	0.68	26	187
Christchurch ..	22	52.8	— 0.7	83.2	30.3	3.20	8	+ 1.35	1.19	3	192
Ashburton	323	51.6	— 1.0	81.2	28.8	2.95	6	+ 0.54	1.14	3	173
Timaru	56	52.5	— 0.5	76.4	33.2	2.04	8	+ 0.38	0.96	3	159
Alexandra	520	50.4	— 0.7	75.0	28.2	1.77	13	+ 0.42	0.43	3	151
Taieri	80	50.0	— 1.3	73.5	30.0	3.47	16	+ 1.37	0.89	3	113
Invercargill airfield ..	9	48.7	— 1.2	70.7	33.0	8.96	21	+ 5.24	1.32	24	77
Chatham Islands ..	140	50.6	— 2.5	64.3	38.2	5.19	20	+ 2.62	0.57	22	

Improvement of Tussock Grassland in Canterbury

IN the past much attention has been given to the fertiliser requirements and management practices to obtain maximum production from what are now considered the fertile areas of New Zealand. It is probably natural that work should have been concentrated on these areas first, and it is almost certain that the economic factor was basically the reason for this. Though the work under review is centred on a series of trials being conducted by one of the authors in the Rakaia Gorge-Lake Coleridge area in Canterbury, many of the implications made can be supported by trials and practical results over a wide area of similar country along the chain of easterly foothills, plains, and mountains in the South Island.

A CERTAIN pessimism, a degree of economic instability, and lack of knowledge have in the past restricted initiative in attempts to realise the potential productivity of marginal tussock areas. Probably the major factor has been the economic one. Perhaps for this reason and because of a degree of alarm at regression and depletion main emphasis was on maintaining the existing state of things. Most endeavours were directed at preventing removal of existing cover, introducing plants to restore depleted cover, and analysis of the factors which were operative in the maintenance or regression of the existing plant associations.

Knowledge gained over the last few years, however, should be brought to bear on the problem. Most of the practices now proving successful have been attempted in the past, but interactions of the factors involved are now much better known, so that practices which then looked hopeless are now being attended with success.

For instance, in the past inoculation of clovers was tried, but nothing was known of molybdenum deficiency; then molybdenum was used without

By W. R. LOBB, Assistant Fields Superintendent, and R. L. BENNETTS, Fields Instructor, both of the Department of Agriculture, Christchurch

HEADING PHOTOGRAPH: Trials to investigate and demonstrate the fertility problems of these areas have been established at "Carriage Drive", Lake Coleridge. Excellent clover establishment on plots in fescue tussock at over 2000 ft. is shown here.

Map showing trial areas, which are marked in red.

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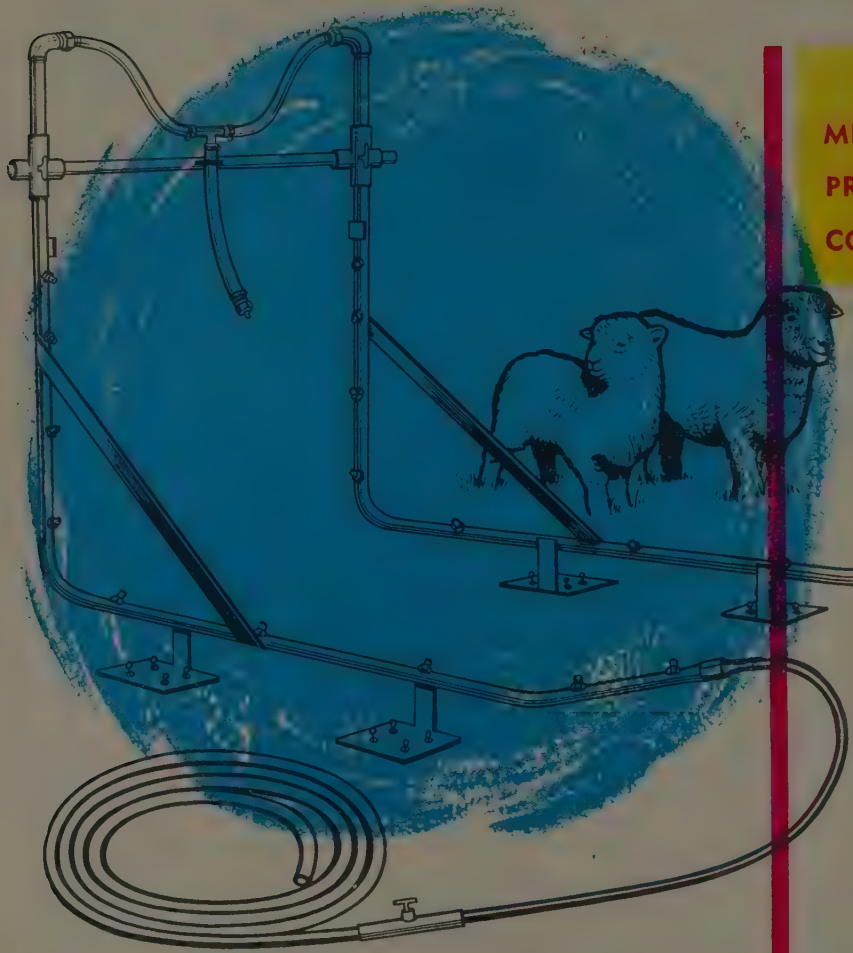

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▲ Tussock grasslands of the South Island are naturally low producing. Grave concern regarding their stability has been expressed. Production on several million acres would approximate a sheep to 5 acres.

← These plots have been treated with a range of the fertilisers referred to in the text. Contrasting establishment between treatments is shown in this trial on Acheron flat.

▼ Such experiments indicate that large areas of tussock country can be made to support healthy, vigorous clovers. This is the result of oversowing clover seed in winter with 1 cwt. of molybdenised superphosphate plus 22 lb. of ground agricultural sulphur.

An outstanding phosphate, sulphur, and molybdenum response is shown on this fenced-off plot. →

INTERIM SUMMARY OF RESULTS OF EXPERIMENTAL PROGRAMME

Over the past 2 years an intensive experimental programme has been directed at solving some of the fertility problems of a large area of unimproved tussock grassland in the Rakaia Gorge-Lake Coleridge area. The trial sites, a considerable distance from the coast, range in altitude from 800 ft. to 2,200 ft. Rainfall varies from 30 in. to 40 in., with fair distribution for a grassland climate, except for occasional summer droughts intensified by hot, drying nor'-west winds. Winters are cold, with many severe frosts and occasional bad snowfalls. The soils are light and cultivation exposes them to severe risk of wind erosion in the nor'-west period.

In the main it is an area of large, extensively managed runs producing fine wool and store sheep. The tussock-covered areas are clean and there are large areas of comparatively flat and rolling land rising to steep, fescue tussock-covered slopes and into the scree of the mountain tops.

Preliminary results from trials and farmers' experience are discussed in this article and what appear to be important advances in the development and rapid improvement of this country are surveyed. This work is still in its early stages and much remains to be done. Nevertheless the great practical importance of the findings to date justifies this interim summary of the position.

▲ Without the correct fertilisers oversowings of clovers are doomed to failure. The plot on the right has been oversown with clover seed and phosphate only. Where molybdenum and sulphur have been added to the treatment excellent clover growth results and this is shown in the plot on the left.

Within the tussock lands there may be some areas → where investigations with inoculants and seed pelleting may be necessary. This illustration shows a number of pots where no establishment of clover seed by ordinary fertiliser treatment resulted (left foreground). The remaining pots show that good clover establishment and growth have resulted from the use of pelleting with lime or charcoal and inoculation. Inoculation on its own is quite ineffective. These soils are from the Mt. Barker flat, Lake Coleridge Station.

▲ A dust-laden north-west wind blowing down the Rakaia Gorge. It illustrates the danger of extensive cultivation as a means of improvement in these areas.

inoculation. Both methods failed. Together, they could have been the key to improving much country. Also many attempts were made to introduce legumes without fertilisers, and in many cases fertilisers proved unavailing because of the absence of clovers. Further failures in the use of both fertilisers and legumes were common because the time of application was unsuitable for the climate.

It is generally supposed that climatic factors, long winters, high altitudes, and the intangible thing "just poor soils" are the factors which limit the improvement of much of these so-termed marginal areas. The climate in some of these areas is not so markedly different from climates where quite high productive pastures can be grown. Even in the higher rainfall areas of the Canterbury Plains soils with negligible production will be found adjoining soils with quite high production and exactly similar climates. As experimental work expands in both scope and knowledge it is becoming apparent that many of these differences are due to variations in the nutrient status of the soils.

Climate certainly imposes limits on productivity, but many of the tussock lands of Canterbury have very good rainfall, but have severe winters. Success with the practices outlined here has been achieved with rainfalls as low as 20 in. to 25 in.

▼ Cultivation of these areas where the soils are light and fluffy can be dangerous, as it allows exposure to severe wind erosion. Prevailing north-west winds have piled a mown crop of hay against this fenceline.

Importance of Legumes

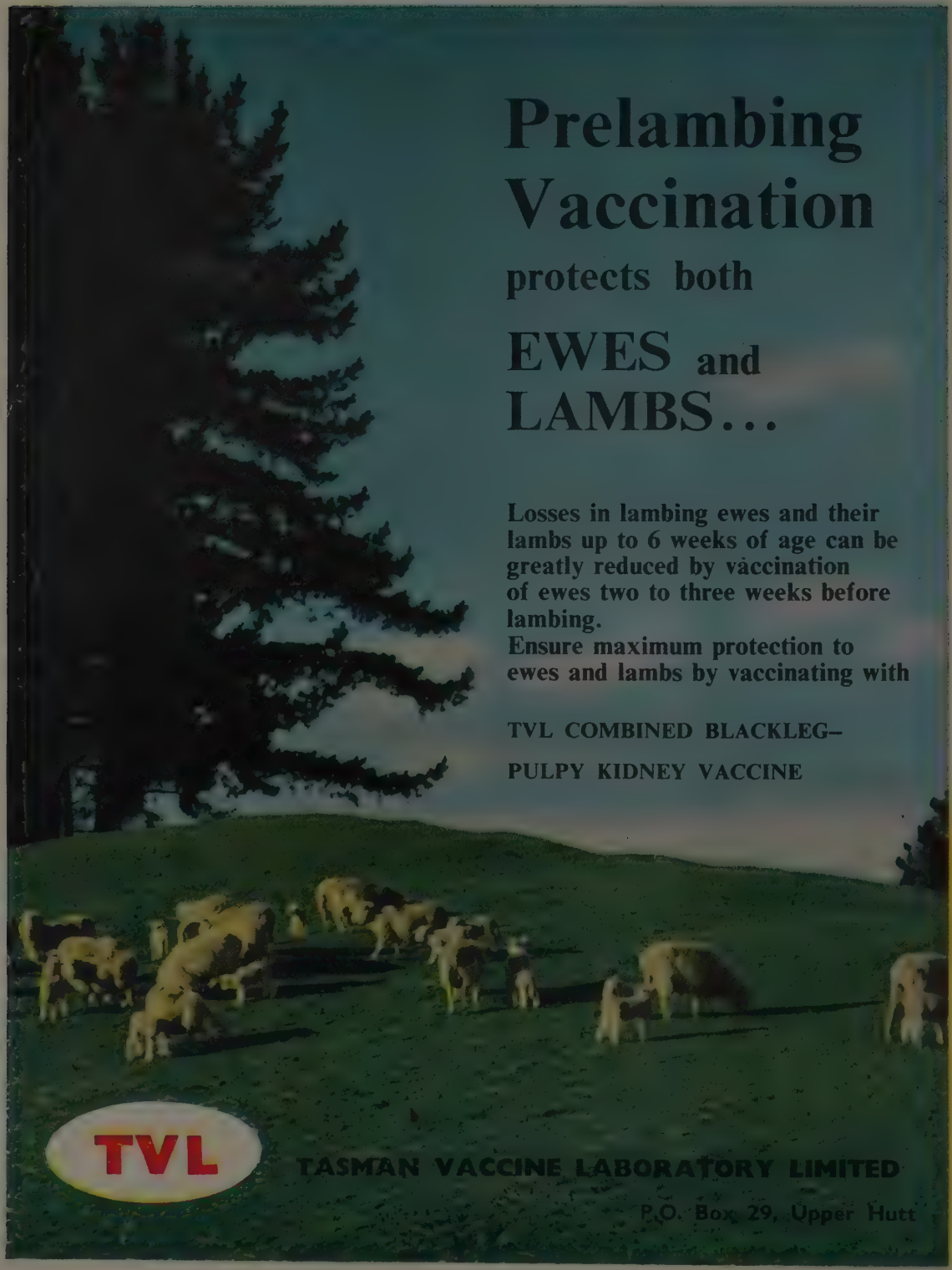
It appears that the introduction of clovers to these naturally low producing swards will be the essential basis for their improvement, and in many cases may be essential to prevent decline. The introduction of new species of grasses without clovers could only maintain the status quo or at the most improve certain country to its former state before depletion took place. Work with grasses, however, is worth while in problem areas where conditions are different.

The first step is therefore the introduction of clovers, and the factors to be considered are the type of sward involved, the time of sowing, and the nutritive requirements to make the clover plant grow vigorously.

Type of Sward

Throughout by far the greater portion of the area the existing cover is an open one of silver or hard tussock with a variable cover of herbs and with browntop invading many places. Some of the browntop is quite dense and in places fescue has at some time been introduced.

In general the whole association lacks vigour, and its ability to respond to favourable growing conditions in the absence of legumes is very limited. In the past many such areas were burnt at intervals to stimulate a little extra, fresh growth. Any extra growth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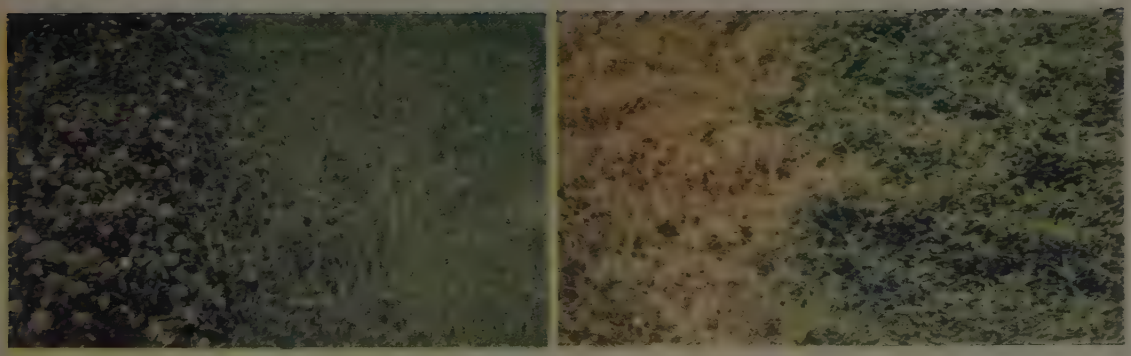

Much experimental work is required to determine the correct fertilisers to use. Left—Molybdenum plus phosphorus plus sulphur on the left and phosphorus plus sulphur on the right. Practically the whole of the response was due to molybdenum only, and trials with molybdenum only gave equal responses on these highly responsive soils in North Otago. Right—In this trial in another district no response to molybdenum could be expected until the deficiencies of sulphur and phosphorus were made good. Molybdenum alone is shown on the left and molybdenum plus sulphur plus phosphorus on the right.

obtained was of a fleeting nature, and the burnt-over areas soon returned to their non-responsive, low productive state. With a low nitrogen status in the soils and a very slow turn-round of animal and plant residues the main reason for their inability to respond to good growing conditions is low nitrogen supply.

Such swards therefore at first offer little competition to introduced legumes. For this reason within reasonable limits as much cover as possible should be left on these swards before clovers are oversown. In general areas should not be burnt or hard grazed, and quite dense browntop and fescue mats offer little resistance to clovers in this unproductive state.

Time of Sowing

The increasing practice of sowing clover seeds in winter was referred to by W. R. Lobb in the February 1953 issue of the "Journal of Agriculture" in an article, "Oversowing and Top-dressing North Otago Hill Country". Since that time a very large number of trials and a very considerable area of tussock country have been successfully oversown in winter.

In practically all cases where the correct nutrient requirements of the clover plant have been known the results have been successful. The best months now appear to be June and July, but provided the principles are known, the period can extend from May to August and in some late districts and backward seasons into September.

The main essential appears to be to sow the seed any time after the ground has become sufficiently cold to prevent germination in autumn, and early enough to have the seed washed into the cover and for the fertilisers to become available to the seedlings before they germinate late in spring.

It does not really matter whether there is frost lift to cover the seed so long as it can wash into the protective cover, and in many cases the cover into which the seed has been sown is too dense and too fibrous to be affected by frost lift.

Germination of seeds winter sown into existing cover of this nature is much slower than that of seed sown into cultivated and prepared seedbeds, and it is found that establishment generally takes place after any risk of late frost has passed.

Though it is realised that winter sowing of clover seed is not readily acceptable to many, so many areas have now been successfully sown in this way that it has become established practice in many districts.

Manganese responses are suspected in seven of the trials. In the left background between the two red pegs manganese sulphate only at 28 lb. per acre was applied. Clover establishment and growth on this plot are very good. Continuing to the foreground at right the manganese plot crosses the phosphate plus sulphur (superphosphate) plot.

An apparent depression which appears to be due to the application of lime may in fact be due to a lime induced deficiency of manganese. The plot on the left shows molybdenum plus phosphorus plus sulphur without lime and the one on the right is molybdenum plus phosphorus plus sulphur with 1 ton of lime per acre in its second season of growth. In the first season the lime plot was better than the unlimed one. The plot in the left foreground was oversown with seed without fertiliser and that in the right foreground was sown with seed plus lime.

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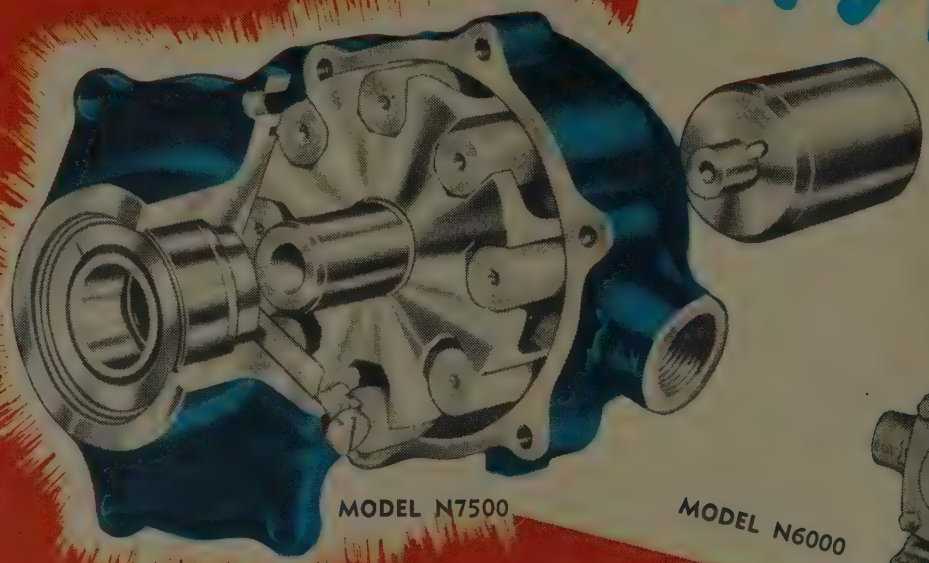

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Nutritive Requirements

Many factors affect the response to fertilisers, and it is essential that these are understood as they apply to each area. The effect of an essential element in pasture growth depends on all of the factors in combination, and none can be taken separately. It is necessary to consider the soil, climate, type of sward, and grazing animal, as well as the various essential elements which might be deficient.

Plant nutrient studies which consider all these points are therefore the obvious starting points in the search for what is needed to make clovers grow in these areas.

Forty trials have been conducted in the last 2 years in the Rakaia Gorge area and a large number elsewhere. From these trials has emerged some valuable information. The main deficiencies so far encountered appear to be phosphorus, sulphur, and molybdenum. Lime applications have given initial responses, but after the first year responses are no better than from the applications of phosphorus, sulphur, and molybdenum without lime, and some are inferior. On these trials there appear to be responses to manganese. From three of the trials it appears that there are some areas where inoculation of the clovers is an initial necessity.

From information gained from this series of trials remarks are made on each of the nutrients mentioned, and because of the obvious variability of the importance of each, the remarks should not be interpreted as applying to all apparently similar areas.

Phosphorus

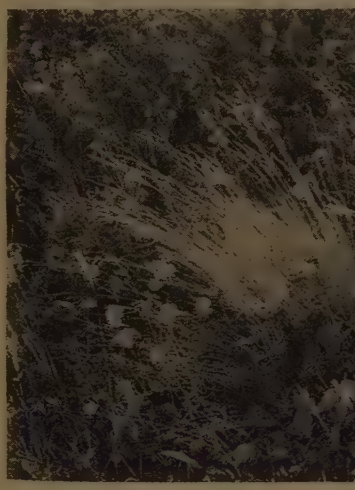
In these trials phosphorus was supplied as superphosphate (thus with sulphur also) and as double superphosphate. The superphosphate was tested for freedom from molybdenum. In none of these trials were the responses to phosphorus only of any significance. Slight responses to it, however, occurred on most trial sites, and there was a tendency for the responses to phosphorus without sulphur to be more marked on the flats than on the steeper slopes. On these flat areas there seems to be a special demand for this element at the initial establishment of the clover plant.

In general the trials show that phosphorus is needed on by far the larger area of this class of land.

Molybdenum

On a fair proportion of these trials molybdenum has given responses, but none of significance in the absence of other nutrients. The response to phosphorus is increased in the presence of molybdenum, but still to no marked extent. The molybdenum response is patchy; some plots on the same trial site which may be less than a chain apart give different results. However, there are sufficient responses to molybdenum additions to indicate that its use is warranted for the first treatment on this class of country.

Though sulphur only can be effective in many cases, there are many areas where this will not be so. Sulphur only is shown on the right and sulphur plus phosphorus on the left. Below, sulphur only has given a marked response.



An area of tussock country where good clover establishment and growth have resulted from a winter application of sulphur only. On sulphur deficient country it will frequently be found that some unthrifty clovers occur in the natural state. In general the class of country that responds to sulphur only would be considered a good deal better than that which has associated phosphorus deficiency. Indeed many areas which are sulphur deficient are extremely good cropping and market garden soils but will not retain healthy legume growth without sulphur.

Sulphur

Sulphur appears to be the most important of the deficiencies, as on all trial sites the addition of sulphur to phosphorus, and to phosphorus plus molybdenum, has brought about vigorous, healthy clover growth. On many sites sulphur alone has given good growth, and its addition to molybdenum treatments has further increased production. Sulphur has been supplied as superphosphate treatments (thus with phosphorus) and as gypsum and elemental sulphur. The results bear out findings with these forms elsewhere ("Journal of Agriculture", November 1954, "Sulphur Investigations in North Otago", and January 1956, "Further Investigations into the Use of Sulphur in North Otago").

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Tussock country on the property of Mr D. Macready in the Rakaia Gorge which was topdressed with molybdenised superphosphate to which an additional 22 lb per cwt. of ground agricultural sulphur had been added. This country was topdressed with the above fertiliser and clover seed in the winter and the photograph taken in December. Excellent results such as these have led to the addition of sulphur to fertilisers once sulphur deficiency has been clearly shown by the experiments of the Department.

There has been some difference, however, between the behaviour of the two forms gypsum (calcium sulphate) and elemental sulphur in the 2 years of the trials. These were two quite different years, 1955-56 being dry in autumn, winter, and spring and 1956-57 being wet in autumn and spring. In the first case from sowings made in winter (July) gypsum gave good establishments whereas sulphur did not. Conditions appear to have been too dry for elemental sulphur to be converted into forms available to plants early enough for the young growing seedlings.

In 1956-57 elemental sulphur gave results as good as or better than gypsum, and in this period the season was favourable throughout. In fact some of the results which favoured sulphur tend to suggest that in a wet season gypsum may be leached more rapidly than the plant can use it. This might be quite important in practice, and will be referred to later.

Lime

The trials indicate that a very large area of this class of land can be improved without the use of lime. Lime responses (at 1 ton per acre) have been recorded in a number of the trials. It is thought that this is in part due to the fact that lime makes molybdenum more available and probably more important in improving conditions for rhizobia bacteria to establish in the clover roots (see the "Journal of Agriculture" for June 1957, Recent Research Work: Sulphur, by R. L. Bennetts). Once the first-year establishment period is over there appears to be no further beneficial effect to the lime application, and sulphur, phosphorus, and molybdenum then seem to be the best treatments. In three trials there is a tendency for the lime plus superphosphate plot to be less productive than the superphosphate-alone plot, and this may be due to lime suppressing the availability of manganese.

Manganese

In seven trials manganese sulphate applied at 28 lb. per acre has given good responses even in the absence of additional sulphur or phosphorus (28 lb. of manganese sulphate would supply about 4 lb. of sulphur per acre, so that this treatment has added both manganese and sulphur). However, the manganese treatment has given an additional response to sulphur (28 lb.), to superphosphate (2 cwt.), and to double superphosphate. The manner in which lime has reacted on these trials suggests that manganese responses are being obtained. This question is being followed up by further experiments.

Other nutrients have been added singly and in combinations, and those tried were copper, boron, magnesium, and zinc, and, with the possible exception of copper, responses have not been obtained. None of them could be considered important at this stage for pasture growth, but with soils of such low initial fertility a constant watch for their importance for both plants and animals should be kept.

Practical Implications

It is now obvious that many million acres of this class of land could be made to support healthy clovers. The main commercial fertiliser available to do this would be molybdenised superphosphate, which would correct three major deficiencies, namely phosphorus, sulphur, and molybdenum. It is essential to sow clover seed if responses to this fertiliser are to be obtained, and in general reliance can be placed on white and red (Montgomery) clovers for this purpose. In some areas the addition of alsike can be considered, and in others subterranean clover.

The areas in which inoculation of clover seeds is also necessary are not clearly defined, but it is now known that this problem does occur, and three trial sites are now showing this. By far the greater portion of the area will, however, give adequate results in the absence of inoculation.

Where inoculation is necessary some treatment to improve conditions for rhizobia bacteria may be necessary. In practice this may be the addition of lime either to the soil in large amounts or as pellets on the seed in very small quantities per acre. This is now under investigation on the areas concerned.

Throughout this trial work an outstanding feature is the importance of sulphur. Trials indicate that the amount being supplied in the normal superphosphate dressings (1½ cwt. to 2 cwt. per acre) may be insufficient for best results.

On trials where 1 cwt. of double superphosphate has been used to supply phosphorus cross treatments of 2 cwt. of gypsum are superior to 1 cwt. of gypsum. Further, in some areas where superphosphate has been used the decline in the response has been fairly rapid and trials indicate that these were the areas in which clovers were very responsive to sulphur. Less rapid decline from superphosphate applications occurs where phosphorus is the element of major importance. Excellent results have also been achieved where sulphur has been added to superphosphate.

It has already been stated that the amount of sulphur necessary to correct this deficiency will vary, dependent on initial deficiency, on season, and on rainfall. It is impossible, therefore, to make an accurate prediction for the use of this element for all cases. It is suggested, however, that where sulphur deficiency is being corrected on legume swards such as clovers and lucerne, a safe approach can be made by making additions of elemental sulphur to superphosphate. Sulphur that contains both fine and coarse particles is preferable.

The rapidity with which these forms become available to the plant was well established in trial work with both crops and pastures in North Otago. It

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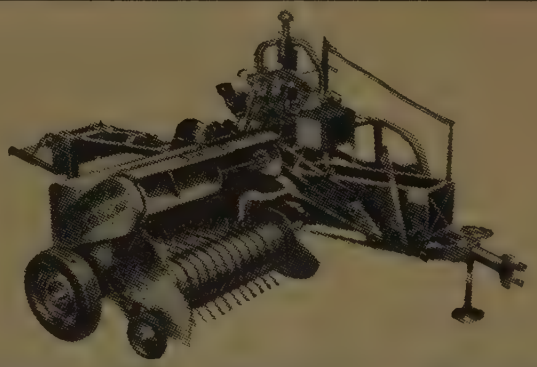

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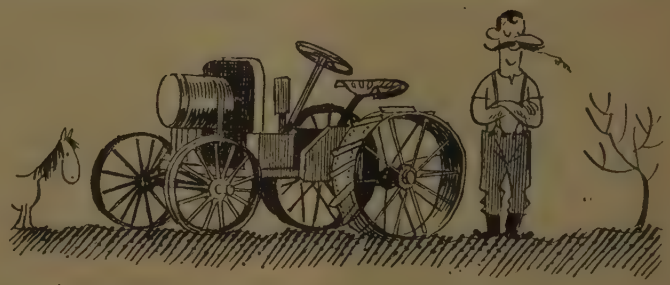

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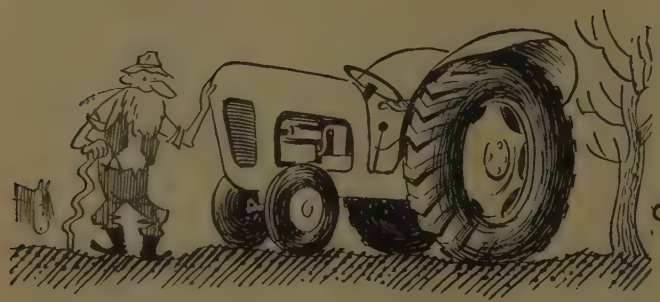

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was well established that for rapid growing crops such as rape only the most readily available form (calcium sulphate or gypsum) was completely effective. Very fine forms such as flowers of sulphur were partially effective and coarse forms were of little use. This held good in pasture, as gypsum gave a very quick effect, flowers of sulphur was delayed, and coarse forms were slow to act.

Some very encouraging results have been obtained in the area under review by additions of about 20 lb. of sulphur to 1 cwt. of superphosphate. When this is done, provided the sulphur contains a portion of both fine and coarse particles, about a third of the sulphur can be provided in each form; that is, a third as sulphate (the gypsum contained in superphosphate), a third as fine particles, and a third as coarse particles (10-mesh sieve).

From such a practice some protection against dry and wet seasons is achieved and a steady and prolonged supply of sulphur is provided for plant growth. Present indications are so encouraging that mixtures such as this are being made available, and several thousands of acres of the tussock land were so treated last winter.

The question of maintenance supplies of the various fertilisers will not be defined until the work has proceeded through several years. It is considered, however, that repeats of molybdenum need not be frequent, and that sulphur will probably be used or leached more rapidly than phosphorus.

From evidence in low rainfall areas it is thought that 20 lb. of sulphur (as gypsum) would begin to lose its effect in about 2 years. Under high rainfall this would take place sooner and decline may take place within a year. This is a further reason for adding a slowly available form, such as that described, to superphosphate. It is still considered desirable to include superphosphate in the first improvement step, to add the quicker acting gypsum, and to supply phosphorus. As it is known that sulphur will correct sulphur deficiency, it is obvious that using sulphur instead of superphosphate to do at least the major part of this is sound and economic.

Management to Aid Establishment

In essence the major consideration in management to aid establishment is the absence of grazing animals during and for some time after the period of germination. In this respect rabbits have been a major bar to any improvement policy for much hill country in the past. It is considered good policy to spell the areas from spring until after seed setting, but some latitude can be allowed, dependent on season and district.

Where spring rains are favourable and summer droughts do not occur, grazing before flowering would not necessarily be harmful. In all cases, however, a good flowering and seed setting should be aimed at in the first year; the first seeding may then be the only one required. The purpose for which the area can best be used will in most cases dictate the early grazing management, but good results have been obtained by using the areas for early winter feeding, thus materially shortening the severe and long winter usually associated with this type of native pasture.

Unsatisfactory establishment occurred on some areas. Experiments with pelleted seed and inoculation indicate that there is a problem relating to the soil near the plant roots in some limited areas. On the right is a drill of pelleted inoculated seed and establishment has been excellent. On the left no establishment followed the sowing of ordinary seed.

It should be realised, however, that utilisation of the growth produced by such practices is important. First, both the nitrogen and sulphur supply of these soils is critically low. The phosphorus can be supplied only by mineralisation from the parent material or by mineral fertilisers. Both the sulphur and nitrogen, however, can be retained in the organic cycle, so that utilisation and turn-round of the fodder produced are a very important step in this respect.

Little emphasis has been placed on the various grass species. It is considered that little need be said other than that many of the existing grasses such as browntop will become relatively good producers once they are associated with vigorous, healthy clovers. The grasses which may be worth consideration for initial introduction are cocksfoot on the very bare areas and dogstail, and to a less extent timothy, on others. It is of little use endeavouring to introduce cocksfoot to low fertility swards of browntop until the clovers have time to lift fertility to support it. Once the clovers have been in existence for some time gradual improvement in the grass components can follow.

Inoculation Problems

On three areas on which there was initial failure to establish clovers further attempts to assess this problem were made in pot trials. A check was made in seed pelleting with both lime and charcoal (carbon) with and without inoculation. It was clearly shown that a problem of unsuitable soil conditions near the roots of the plants did occur. Pelleting, irrespective of inoculation with either lime or charcoal, was effective in obtaining establishment, and inoculation was then effective in producing healthy growth.

At present work is in progress to determine a practical way of using pellets on these few problem areas. Further work is clearly necessary because there is no certainty whether oversowings, as distinct from subsurface introduction, especially if done in winter, will be effective where pellets and inoculation have to be used.

Conclusions

The fertility problems of an area of previously very low productive tussock grassland have been considered. It appears certain that a very significant area of this class of country has undoubted potential once these problems are understood and clovers are introduced.

Some of the salient features have been covered and the essentials appear to be: first, oversowing suitable clover seeds from the air, which need not require any seed-bed preparation or sub-surface introduction with sod seeders; secondly, the provision of suitable fertiliser nutrients is necessary; and, thirdly, the most suitable time to sow into these conditions appears to be mid-winter. Though some areas are likely to have an additional problem of inoculation, it is stressed that a very large area can be treated as described here without resource to seed inoculation or without the complication of seed pelleting.

Care of Livestock during July

Contributed by the Animal Research Division

IT is imperative that cows should be well fed for 6 to 8 weeks after calving. They should have access to hay at all times, and if the pasture is poor, they should also receive up to 20 lb. of silage per day. Early-calving cows should be given about 2 hours' grazing per day on autumn-saved pasture and, in addition, should be fed as much silage as they will eat.

WINTER FEEDING OF COWS

At the start of a new season cows should be trained to let down their milk quickly and completely by the establishment of a fixed milking routine in which they are brought into the shed, bailed up, washed, and milked in the same way at each milking. Anything which upsets the cows must be avoided. A brief but vigorous wash followed by the withdrawal of a squirt of milk from each quarter into a strip cup is the best method of stimulating the flow of milk. This will also help in detecting cases of mastitis early.

MILKING METHODS ARE IMPORTANT

As the duration of let-down is limited, cups should be put on immediately after the washing and starting process. A good milk flow indicator should be used, and as soon as this shows that milk flow is slowed to ½ lb. per minute the cups should be pulled down until milk flow again falls to this rate, when they should be removed at once. Massaging of the udder while the cups are pulled down should be done only with cows which are known to need it.

Hay made from ergotised grass will cause lameness and sometimes even loss of feet in cattle. The small black ergots which replace the seeds of ryegrass and other grasses can be easily seen, and if they are present in large numbers, the hay should not be used. Similar trouble often occurs when cattle are grazed on tall fescue grass, even when no ergots are present. This grass should be regarded as poisonous and should not be grazed by cattle.

ERGOTISM IN CATTLE

Heading photograph by National Publicity Studios.

Where pulpy kidney occurs in lambs under 6 weeks of age its incidence can be reduced by vaccinating the ewes before lambing. If ewes have never been vaccinated before, best results will be obtained from two doses of vaccine given at least 1 month apart. Ewes which were vaccinated last year will require only one vaccination. The last (or the only) vaccination should be given about a fortnight before lambing and this can be done quite safely if ewes are handled carefully. Very poor immunity results where the ewes are vaccinated much earlier. If most losses from pulpy kidney occur in lambs over 6 weeks of age, vaccination of ewes is of no value, but vaccination of lambs at marking, with a second dose later, may help.

PULPY KIDNEY IN LAMBS

Losses from blood poisoning in lambing ewes and marked lambs can be greatly reduced, if not eliminated, by vaccinating the ewes with blackleg vaccine about a fortnight before lambing. As the immunity which passes from the ewe to the lamb in the first milk does not persist for many weeks, lambs should be marked early. To obtain the best results it may be necessary to divide the ewes into early and late lambers, which should be vaccinated separately before lambing.

BLOOD POISONING IN EWES AND LAMBS

Advice on vaccination can be obtained from any office of the Department of Agriculture. Where possible, ewes should lamb in clean spelled paddocks, and lambs should always be marked in clean temporary yards. Sometimes losses from blood poisoning occur in lambing ewes that have not been vaccinated. If losses are occurring, it is too late to vaccinate. It may be possible to save some ewes by treating them with penicillin if the penicillin is used early enough. It is important that blood poisoning be confirmed, and the local veterinarian should be consulted. After such confirmation all ewes which are assisted in lambing should be treated by penicillin injection. This should be an emergency measure and should not replace vaccination, which is the cheapest and most certain means of preventing blood poisoning.

Heavy losses from sleepy sickness sometimes occur in ewes carrying twins or heavy single lambs. These losses may be prevented by ensuring that ewes do not suffer a check just before lambing. If necessary, they should be divided into early and late lambers and drafted on to the best feed available 3 to 4 weeks before lambing. Research has shown that poor feed for 5 weeks before lambing can reduce the fleece weight by more than ½ lb.

SLEEPY SICKNESS IN EWES

Ringworm in calves is sometimes troublesome, especially in poorly nourished calves. Before any remedy is applied the scales should be removed by rubbing in a mixture of equal parts of soft soap and lard and scraping off the softened scabs the next day. The bare patches should then be dressed with an ointment consisting of 1 part of salicylic acid and 8 parts of lard, or any registered stock remedy for ringworm which is available. As the infection can be transmitted to man, it is wise to wear rubber gloves when treating ringworm. In any case the hands and arms should be thoroughly washed immediately after the dressings are applied.

RINGWORM IN CALVES

Pasture and Crop Production

Seasonal Notes by the Extension Division

THE demand for seed wheat has recently been very heavy, and farmers who intend sowing wheat this spring should order it as soon as possible. Information on varieties and cultivation for spring-sown wheat is given here.

SPRING-SOWN WHEAT VARIETIES FOR SOUTH ISLAND

MOST of the wheat in the South Island is grown in Canterbury and North Otago, where autumn sowing is usual. For spring sowing, which is normal in Otago and Southland, the most successful variety in the past has been Cross 7. Hilgendorf, though a premium wheat because of its high baking quality, has not yielded as well as Cross 7 in most districts. Gabo, Arawa, and Aotea are new varieties which in trials have been superior to Cross 7 and appear to be suitable under a wide range of soil and climatic conditions. All the varieties mentioned are very suitable for spring sowing in the South Island.

Most spring wheat is sown to follow supplementary winter feed crops, and as soon as these are fed off areas should be ploughed. Early in August cultivation with discs and/or cultivators should be begun and areas finally harrowed to provide a fine, firm seedbed. Too fine a surface tilth should be avoided, as it encourages weed growth and compaction of surface soil after heavy rain, which often results in a low-yielding crop.

Sowing should begin in August and be completed not later than the end of September in the southern part of the island. Later sowings mean later harvesting, which should be avoided. The seeding rate should be 2½ to 3 bushels per acre drilled at a depth of 2 in. with 1½ to 2 cwt. of superphosphate.

—H. A. DUFF

* * *

NITROGENOUS FERTILISERS

PASTURE growth is slow in winter because cold weather restricts the activity of the nitrogen-fixing nodules on the clover roots. As nitrogenous manures from the bag can never hope to compete with clovers, but can help when clovers are not growing actively, they are best used to fill the gaps in pasture growth in winter.

Pastures to be treated with nitrogenous manure for out-of-season grass should contain plenty of perennial ryegrass, short-rotation ryegrass, or other winter-growing grasses. Ensure that the paddock has plenty of lime, phosphate, and potash before applying the limiting factor—nitrogen. Choose paddocks that are free draining, because often feed can be grown but it cannot be grazed without being spoilt by pugging.

In some districts such as Northland autumn growth can be slow; therefore, the application of a nitrogenous manure from late April-May will produce extra growth for feeding in June and July. July is usually the best time to apply quick-acting nitrogen to provide extra feed in August. June is normally cold and wet, conditions which prevent a response to nitrogen.

One hundredweight of sulphate of ammonia or its equivalent in mixtures is the usual dressing. If nitrate of soda is used, 1¼ cwt. per acre is needed. For best results all nitrogenous manures should be put on in mild, showery weather.

—G. B. HADDOW

* * *

FODDER BEET

FODDER beet, or as it is sometimes called, Danish fodder beet, was introduced into New Zealand early in the 1950s. It is a sugar beet-mangel cross. Fodder beet is ideal for feeding to pigs and can be used for fattening late-summer litters or early-spring pigs as well as for carrying stores through winter. Normally the crop is pulled and fed out, but some varieties have been successfully break grazed with an electric fence. The tops are quite nutritious, but may cause digestive upsets, especially in young pigs, and it is best to pull and wilt them the day before feeding out.

Fodder beet has now almost completely replaced mangels for pig feeding. Though per-acre yields may be less than half those of mangels, the dry matter content of the bulbs is appreciably greater. It is thus ideally suited for digestion in the simple stomach of the pig.

Fodder beet can be transplanted or drilled and subsequently thinned. Drilling is usually preferred, rows being 21 to 28 in. apart and 4 lb. of seed per acre being required. The crop should be put in with at least 5 cwt. of manure per acre, preferably equal parts of blood and bone and reverted superphosphate. An overdressing of 1 cwt. of sulphate of ammonia per acre is well worth while when the plants are well established.

Good weed control has been obtained by pre-emergence spraying with 15 to 20 lb. of TCA per acre in 30 to 40 gallons of water when, or shortly after, the beet seed is drilled in. The crop usually requires some hand labour for thinning and weeding.

—D. M. E. MERRY

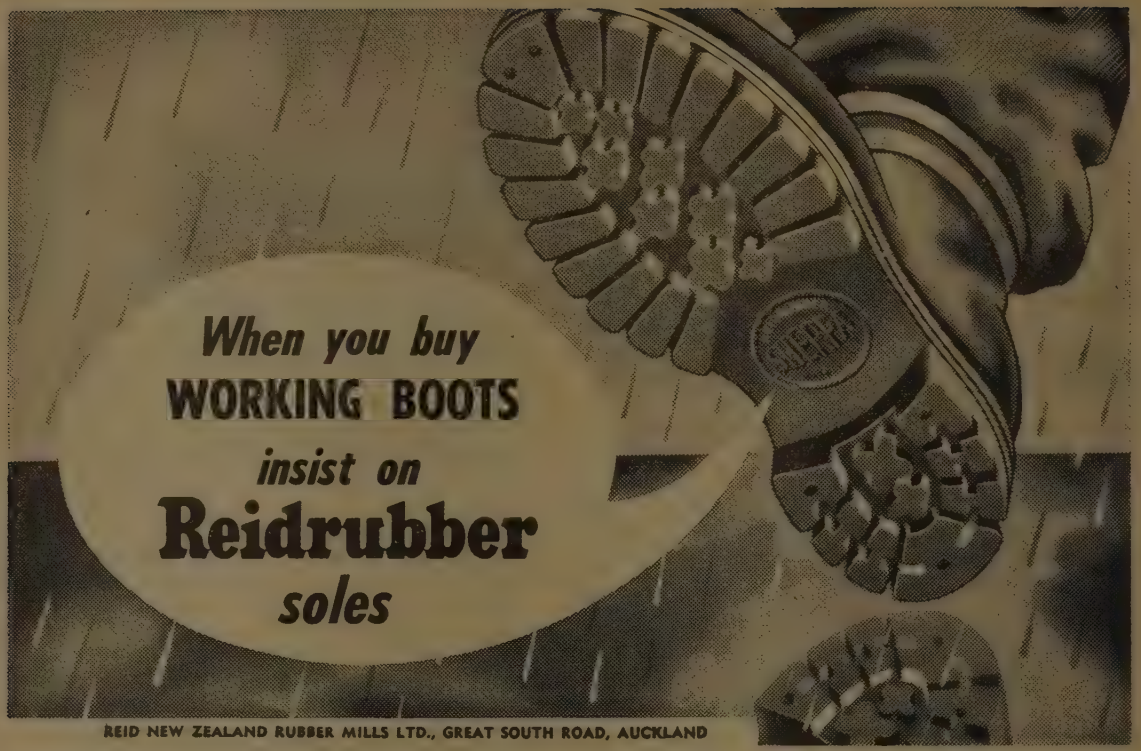
* * *

FARM ACCOUNTS

FARMERS who end their financial year on 30 June should at that time go over their statements showing details of income and arrange them under product headings, for example, wool, lamb receipts, monthly butterfat statements, etc. Invoices should be brought together with monthly statements to which they belong and the statements arranged in date order. Cheque butts should be perused and an adequate notation of expenditure made on them if this has not previously been done. This will help the accountant acting for the farmer to reconcile actual payments with the statements and invoices. Also a list of the livestock on hand at 30 June should be drawn up with a list of stock deaths. These figures will enable the accountant to reconcile the stock numbers at the end of the financial year with those at the beginning of the year.

A little thought and care by the farmer on the above lines will save letters and telephone calls from the accountant to check on some of these points. After all, the 31 March and 30 June are busy periods for accountants who have farmer clients, and a little care by the farmer will enable the accountant to complete the Farm Trading Account and Profit and Loss Account and Balance Sheet more expeditiously and in a more satisfactory manner.

—R. H. SCOTT



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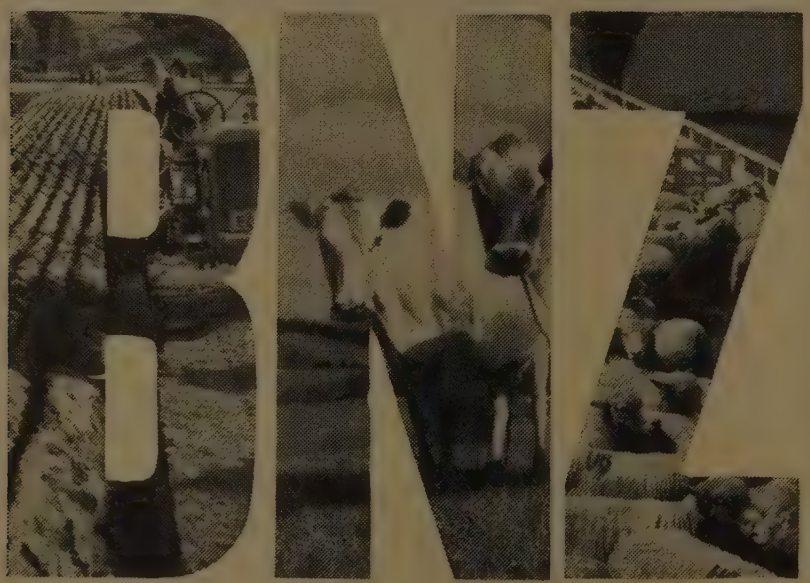

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High-energy Foods are Valuable for Laying Pullets

By J. EDMONDSON,
Poultry Experimentalist,
Department of Agriculture,
Upper Hutt

DETERMINATION of the economic efficiency of laying mashes, measured in terms of the cost of food required to produce a dozen eggs, has been the objective of feeding trials carried out in 1957 by the Department of Agriculture at its Poultry Demonstration Plant, Upper Hutt. A review of the results of these trials is given in this article.

THE assessment of food efficiency is directly influenced by egg production, and for maximum efficiency high production is necessary. Any factor apart from the food consumed which lowers egg production is reflected in food efficiency measurements. Most of the food consumed by a layer is used for the function and repair of the body and only a small fraction of the daily food intake is used as raw material for egg production. A bird laying 100 eggs a year needs just about as much food for body maintenance as one laying 200 eggs a year, whereas the higher producer needs only a fraction more food than the lower producer to meet the nutritional demands of another 100 eggs. A diet for laying birds should therefore contain the right proportions of protein, minerals, and vitamins to ensure maximum egg production.

Energy-content Factor

In addition to these factors the energy content of a ration influences egg production. The energy content of a ration for layers can be measured in calories in much the same way that calories are counted in the human diet. If adequate minerals, vitamins, and protein are supplied, the quantity of a ration needed for a laying flock will depend on the number of calories supplied in each pound of food. The more calories there are per pound the less food will be needed to supply energy and to produce a given number of eggs.

The energy value of a mash depends on the energy content of the ingredients used. The following list shows the energy value of different grains.

During a laying year a good pullet eats about 100 lb. of food, of which two-thirds should be mash and a third grain. The mash must be mixed with ingredients of high nutritive value, as only then will the ration be economically efficient.

	Calories per pound
High energy	
Maize	1,145
Wheat	1,025
Medium energy	
Heavy oats	817
Barley	811
Low energy	
Light oats	642
Pollard	581
Bran	478

Economic Efficiency of Food

A useful measure of the efficiency of a food for egg production is the number of pounds of it required to produce a dozen eggs. Though when mashes are compared this measurement will show in simple terms which mash is most efficiently converted into eggs, another factor which must be considered is the cost of the food. It is important to know not only how much food is required to produce a dozen eggs but also how much that quantity costs. **The cost of food required to produce a dozen eggs is the final basis on which the economic efficiency of a mash is judged.**

An example with two different rations is given here.

	Ration 1	Ration 2
Cost of food per pound	6d.	4d.
Food per dozen eggs	4 lb.	6 lb.
Cost of food per dozen eggs	2s.	2s.

Ration 1 shows a much more efficient conversion rate, but because it is more expensive it is no more economic to feed than Ration 2. Both are therefore equally efficient economically.

Objectives of Trial

With the full realisation that the energy value of a diet for layers has an important bearing on efficient egg production, the Department conducted the feeding trial described here at its Poultry Demonstration Plant, Upper Hutt. The objectives were:

1. To demonstrate the effect of replacing low-energy grain products such as bran, pollard, and oats with high-energy ingredients, thereby increasing the energy value of the food.

2. To determine the effect of an increase in protein in a high-energy mash. Because a level of 15 per cent protein is commonly recommended for a layers' diet and because the high-energy mash proposed would result in reduced food intake and consequently reduced protein, it was desirable to try a ration containing more protein.

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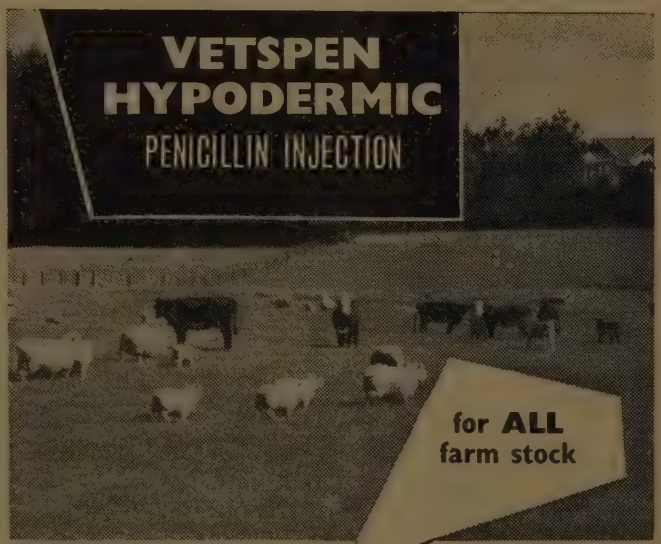

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3. To demonstrate the effect of using an antibiotic in the ration. For this purpose two types of mash were used with the remaining pens and birds available, a high-energy, high-protein mash as above, and a bought Standard Layers' Mash No. 1 with a comparatively low level of protein.

Trial Method

The trial was started at the beginning of March 1957 and continued for 36 weeks. Rhode Island Red x Australorp pullets were selected on a random-sample basis and were housed intensively at point of lay. Six groups of birds were used, each group comprising two pens of 45 pullets, a total of 90 pullets per group. They were fed as follows:

Group

1: Low-energy mash; normal protein level.

2: High-energy mash; high protein level.

2a: As for 2 plus an antibiotic.

3: High-energy mash; normal protein level.

4: Standard Layers' Mash No. 1 plus vitamins A and D_3.

4a: As for 4 plus an antibiotic.

The mash ingredients were:

	Mash 1 (low energy)	Mash 2 (high energy, high protein)	Mash 3 (high energy)	Mash 4
	lb.	lb.	lb.	
Bran	400	80	80	
Pollard	540	80	80	
Ground wheat	300	900	1,040	
Ground maize	200	300	300	
Ground barley	180	—	—	
Meat meal	200	440	300	
Ground oyster shell	20	40	40	
Salt	20	20	20	
Dehydrated lucerne	140	140	140	
Manganese sulphate	¼	¼	¼	
Vitamins A and D_3	As recommended by the manufacturer			Bought Standard Layers' Mash No. 1
	2,000½	2,000½	2,000½	
Protein content by analysis, per cent	17½	21½	18	16
Estimated calories per pound	730	865	885	*

* Could not be estimated.

The above "grain balancer mashes" were fed dry in hoppers and were available to the birds at all times. A strictly controlled quantity of whole wheat was fed in the litter in the afternoons at the rate of 1½ oz. per bird per day. Oyster-shell grit and hard grit were available to the birds free choice. This programme of feeding was adopted as one commonly used by poultry farmers keeping birds intensively.

The above mashes when fed with the whole wheat as described gave the following estimated protein and energy levels in the total diet of mash and grain:

	Mash 1 (low energy)	Mash 2 (high energy, high protein)	Mash 3 (high energy)	Mash 4 (standard)
Protein, per cent	15	17	15	14
Calories per pound	825	930	940	?

Prices given below for the mashes were based on average ruling prices of ingredients, and do not include cost of mixing or of transport to the farm, as these are a common factor and do not influence comparative studies.

Results of Trial

Results of the trial are given as three comparisons between the mashes used. No significant differences were found in total egg production or in mortality between the different feeding groups, and as the amount of whole wheat fed to each group was virtually the same, the only comparisons reported here are expressed as the amount of mash and the cost of mash required to produce a dozen eggs.

COMPARISON 1

	Mash 1 (low energy)	Mash 2 (high energy, high protein)	Mash 3 (high energy)
Protein per cent	17½	21½	18
Calories per pound	730	865	885
Cost per ton	£25 8s. 9d.	£28 5s. 7d.	£28 2s. 3d.
Pounds of mash per dozen eggs	5.86	4.62	4.88
Cost of mash per dozen eggs	17.89d.	15.68d.	16.47d.

Though Mash 1 was much cheaper than Mashes 2 and 3, it proved much more expensive as feed, as 5.86 lb. at a cost of 17.89d. were required to produce a dozen eggs.

Of interest is the comparative efficiency of Mashes 2 and 3 in food conversion and cost of food to produce a dozen eggs. The only important difference between the two mashes is the protein level. When fed with grain Mash 2 gave a protein level of approximately 17 per cent of the total food intake and Mash 3 a 15 per cent level. The difference in economic efficiency is sufficient to warrant a further test which is now being conducted.

COMPARISON 2

	Mash 2 (high energy, high protein)	Mash 2a (Mash 2 + antibiotic)
Protein per cent	21½	21½
Calories per pound	865	865
Cost per ton	£28 5s. 7d.	£29 6s. 7d.
Pounds of mash per dozen eggs	4.62	5.09
Cost of mash per dozen eggs	15.68d.	17.92d.

Mash 2 was the same mash as shown in Comparison 1. The only difference between Mashes 2 and 2a was the inclusion in the latter of an antibiotic, procaine penicillin.

Inclusion of an antibiotic was obviously of no advantage to the formulated mash and in fact resulted in less efficiency in terms of food conversion into eggs and increased the cost of feeding by 2.24d. per dozen eggs.

This comparison demonstrates a point made by reliable authorities that antibiotics are not economic when fed to healthy layers. When there is an outbreak of some disease known to respond to one of the antibiotics there would be good reason for its inclusion.

COMPARISON 3

	Mash 4 (standard)	Mash 4a (standard + antibiotic)
Protein per cent	16	16
Cost per ton	£24 5s.	£25 6s.
Pounds of mash per dozen eggs	5.69	5.74
Cost of mash per dozen eggs	16.56d.	17.43d.

Mash 4 was a combination of two bought mashes both labelled Standard Layers' Mash No. 1 and to which was added vitamins A and D_3.

Here again the addition of an antibiotic as in Mash 4a appeared to have no effect except to increase the cost of the mash and consequently the cost of egg production.

When grain was fed with the commercial standard mash with a 16 per cent protein level this gave a protein level of 14 per cent of the total food intake. Egg production of groups fed with this mash was similar to that of other groups. The food conversion ratio of food to eggs was typical of a mash containing a large proportion of bran and pollard (a low-energy mash), similar to Mash 1 in Comparison 1.

High-energy Foods More Economical

Summarised, the results of the trial show that:

1. Replacement of low-energy grain products such as bran and pollard by high-energy grain products such as wheat and maize resulted in a more efficient mash. Though cost of mash per ton was increased, the amount of food and the cost of food required to produce a dozen eggs were significantly less.

2. There was evidence that the efficiency of a high-energy mash of the type tested could be improved still further by increasing the protein level.

3. Under the conditions of the trial the only effect of using an antibiotic was to increase the cost of the mash and consequently the cost of production. Efficiency of egg production in terms of pounds of food and cost of food required per dozen eggs was not improved.

SEED PELLETING

A NUMBER of seed-pelleting experiments have been undertaken by the Extension Division of the Department of Agriculture in the past 2 years. Seed is pelleted by coating it with a layer of a substance such as fertiliser or lime. Most of the work done has been concerned with the coating of seed with small amounts of lime. The beneficial effects of this were established by A. J. Anderson, Commonwealth Scientific and Industrial Research Organisation, Australia, who found that a small amount of lime added to the seed in this way was sufficient to obtain good nodulation of clover seedlings when the seed was sown on acid soils.

RATES OF LIME LIME at 2 to 3 lb. per acre when used as a coating on the seed was efficient in obtaining nodulation, whereas 2 to 3 cwt. sown in contact with the seed or from 1 to 3 tons broadcast were needed for similar effects. It was concluded that the localised effect of this small amount of lime was sufficient to correct acidity in the immediate vicinity of the germinating seedling and thus to obtain satisfactory inoculation.

LIME AND CHARCOAL A pot experiment on pelleting was begun in New Zealand in October 1956 with three Canterbury soils in which clovers had failed to inoculate.

The treatments used were lime-pelleted seed with and without inoculum and charcoal-pelleted seed with and without inoculum.

In the early stages healthy, vigorous clover plants were obtained in all treatments which had seeds pelleted with either lime or charcoal, whether these had been inoculated or not. All these plants were nodulated.

When the seed was not pelleted few plants survived and none was vigorous and none had nodules.

In the later stages of the experiment the inoculated plants were more vigorous.

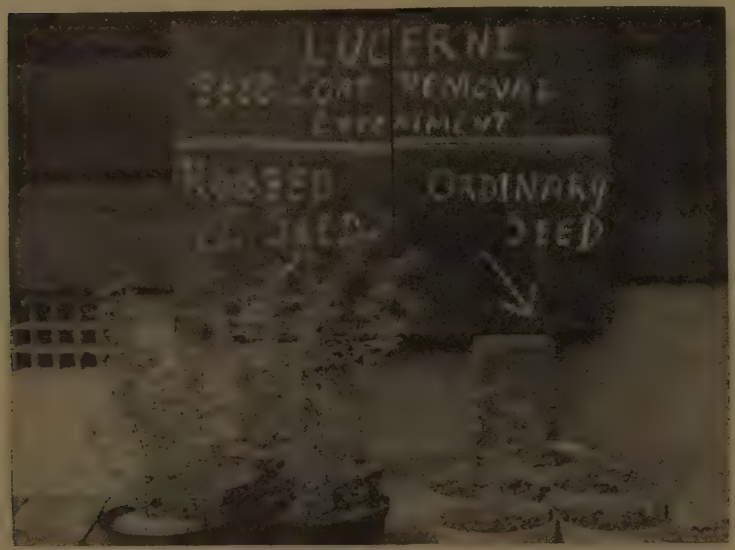
It appeared from this experiment that pelleting might not necessarily have corrected soil acidity, and that some other factor might have contributed to the failure of the clover plants from unpelleted seed to nodulate.

A possible explanation for the reason why charcoal may be effective in assisting nodulation has been advanced as the result of work done by E. R. Turner of the Rothamsted Experimental Station, England. He concluded that the stimulation given to nodule production was due to the absorption by the charcoal of inhibitory compounds secreted by the clover roots.

To test the possibility that such compounds may be present in the seed coat of legumes parts of the seed coat of lucerne seed were rubbed off by gently rubbing the seed on fine sandpaper. These seeds were grown in pots in Christchurch alongside seeds from the same line of seed but which had the seed coat left intact. In five pairs of treatments the seed was inoculated and in the sixth there was no inoculation.

As might be expected the germination of the seed which had been rubbed was quite severely affected, but a number of seeds germinated in each pot.

The results of this experiment are shown in the illustration. The untreated seedlings were poor whether inoculated or not, though more plants were obtained in each pot. The seedlings from the rubbed seed grew vigorously, were dark green and healthy, and well nodulated whether inoculated or not. Unfortunately, only one seedling grew in the pot which had rubbed and uninoculated seed. This plant, however, was quite healthy and nodulated.



This experiment suggests that inhibitory substances may be present in the seed coat of various legume seeds.

LUCERNE FIELD TRIAL A field trial with lime-pelleted lucerne seed has also given interesting results. This trial consisted of three replicates of the four following treatments: (1) Lime-pelleted inoculated seed; (2) lime-pelleted uninoculated seed; (3) unpelleted inoculated seed, and (4) unpelleted uninoculated seed. In this trial all plants from pelleted seed had nodules whether the seed was inoculated or not, and the initial growth and vigour were much ahead of the unpelleted seed. Plants in the unpelleted treatments were not nodulated, whether they had been inoculated or not. This soil had been well limed and had a pH of 6.2 before the experiment began.

—W. R. LOBB

Peat Farmers' Field Day at Rukuhia

A general view of a fully developed peat area.

DURING the past 11 or 12 years research into the development of the large peat areas in the South Auckland district has been pursued at the Rukuhia Soil Research Station, and many articles concerning progress in this work have been published in past issues of the "Journal". Local farmers have shown keen appreciation of and great interest in this work and have regularly attended the annual field days dealing with this subject which have been sponsored by the Peat Committee of Federated Farmers.

OBVIOUSLY a field day of this sort is relatively restricted in its interest, but it is usual for between 100 and 200 farmers to attend, depending on the weather and the urgency of seasonal work. A field day held in November was attended by about 100 farmers and was notable for the interest they showed in the work being carried out.

▼ A thoroughly interested spectator gets down to earth.

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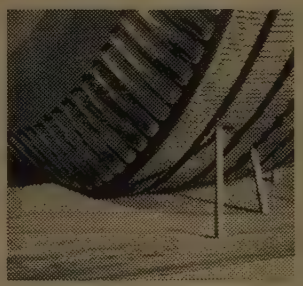

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First Breaking in of Peat

The Moanatuatua peat swamp area in the Ohaupo district, some 9 miles from the Station, was first visited. Here I. L. Elliott, Superintendent of the Station, explained the stages in the breaking in of a raw peat area up to 35 ft. deep and previously completely untouched. The procedures necessary to establish grass, types of drainage required, cultivation and fertiliser treatments for crops, and the benefits to be derived from the use of copper on this type of land were convincingly demonstrated.

Trace Elements

F. C. C. Hupkens van der Elst, Research Officer in charge of this section, outlined the experimental work on trace elements and described the progress of the work with copper. He added that it was always hoped that there would be something new and spectacular to show farmers each year when they visited these areas, but that on this occasion no spectacular progress made during the last year could be demonstrated. He said, however, that a treatment which he had just given to some very unhealthy looking grass plants might hold great promise for the future, and demonstrated how time-consuming research work must be before it is possible to turn the results of work over to farmers for their adoption or rejection in the field.

Water-table Control

A short visit was made to the newly established area at Lake Cameron where work is in progress mainly to

Undeveloped peat land at Lake Cameron.

▼ The same area about a year later. With control of the water-table a wide variety of crops is being grown.

demonstrate the suitability of peat for growing a wide range of horticultural crops and the benefits to be derived from accurate control of the water-table. Experimental work of this nature has already been done at the Rukuhia Soil Research Station, but not on a scale large enough to demonstrate the practical possibility of such methods. This aspect is regarded as of the very greatest importance in the development of the peat areas in the South Auckland district, which extend over about a quarter of a million acres.

It was pointed out by both Mr Hupkens van der Elst and Mr Elliott that the methods tried, though new to this country, had long ago been used in the vast areas of peat country in Europe and the United States, and probably more than any other factor water-table control would be responsible for developing the true potential of these lands.

As peat farmers in many cases have problems common to all farmers such as weed control and fertiliser applications, a short quiz session was arranged immediately after lunch at the Station, when J. Karlovsky, who specialises in fertiliser response trials, and F. B. Thompson, Agricultural Chemist, answered questions and had a short but spirited discussion on matters related to their own particular fields.

The field day concluded in the afternoon with a visit to the experimental plots on the estate of Mr E. G. Houchen, where demonstrations were given on pasture management and responses to applied copper sulphate.

The staff of the Station were thanked by Mr Campbell Henderson, chairman of the Peat Committee of Federated Farmers, who paid a warm tribute to the work being carried out by the Station, and indicated how much farmers had gained from the concerted attack made by members of the staff on a complex and difficult problem. He praised, also, the work by the Department of Lands and Survey in the conversion of a large block of 2,400 acres of peat land in the middle of the Rukuhia swamp, the development of which had completely changed the appearance of the rail approach to Hamilton from the south. This development had been possible only through the work undertaken at Rukuhia, and the Station staff had made a notable contribution in working with the Department of Lands and Survey on this project.

Tree Planting in Gullies Promotes Stability

By A. A. DUNCAN,
Instructor in Agriculture, Department of Agriculture, Wanganui

THE lowering of stream beds through their gradual wearing down by the constant flow of water is the primary cause of most of the serious erosion on the relatively soft mudstone or sandy mudstone hill country of the North Island. The sides of the gullies slump into the streams and this causes progressive slipping further up the hillsides.

IN the past logs and stumps in many of the stream beds acted as an effective protection against the abrasive effect of the water and kept the stream beds stable. These logs and stumps, which have been in the streams since the felling of the bush, have now rotted and are no longer effective as stream-bed stabilisers, and in consequence the problem of degrading streams is increasing; streams which have been stable for the past 50 years have now started to degrade.

How Trees Check Erosion

The illustration shows willows growing in the bottom of a gully which would have a high slipping potential if the bed of the stream was

allowed to degrade. The gully sides are long and steep and the soil is of a rather crumbly sandy mudstone. The roots of the willow trees, however, have formed an effective mattress for the water to flow over and have tended to raise the stream bed. The trees are a further advantage in that the roots and trunks act as a barrier to the flow of the water in peak periods and hold it back to some extent.

Unfortunately, the planting of hill country gullies is by no means as common as it should be. In many districts this is because opossums damage the young trees, and any extension in planting must go hand in hand with the ruthless extermination of opossums.

Stability of Gully Beds

It is important, nevertheless, that more gullies be planted, because stable gully beds are a big factor in successful hill country farming. Stable gully beds facilitate the maintenance of stock crossings and fencelines and enable a good sward of grass to be maintained on the gully sides. It is relatively inexpensive to plant gullies before degrading becomes apparent, but it is a very different story when serious degrading has set in; in this case some form of stone or netting wire structure has to be used to get some stability before successful tree establishment is possible. Very often stones have to be transported a considerable distance and this makes the job very expensive.

The establishment of trees in gullies ranks in importance with such factors as fencing and subdivision in the maintenance and improvement of the carrying capacity of hill country, and no effort should be spared to increase substantially the present limited number of well planted gullies.

To be completely effective as an erosion-control measure the planting of gullies should be accompanied by other conservation practices such as controlled grazing and the building up of fertility to promote better pasture on the sides of the gullies. Topdressing with phosphatic fertiliser and oversowing with the type of clover that suits the particular locality are two important factors in improving pasture cover and building up fertility. A system of grazing management that allows some top to be kept on the pasture for as much of the year as possible, as opposed to a system of hard, close, and continuous grazing, helps considerably in reducing the amount of erosion.

The finishing section of a clover seed-dressing plant.

Seed Production in New Zealand

Seed Cleaning of Grasses and Clovers

By P. R. BARRER,
Instructor in Agriculture, Department of Agriculture, Christchurch

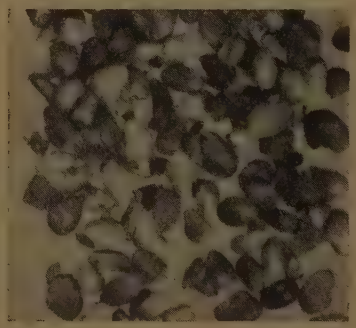
THE extent of the grass and clover seed industry in New Zealand and its value not only to the export trade but also to the home consumer were shown in the introduction to this series in the February 1957 issue of the "Journal". It is obvious that for an efficient seed-producing industry proper seed cleaning is essential, not only for the reputation of New Zealand seed overseas, but also for the benefit of New Zealand pastures. The seed-cleaning machines which are responsible for the good results achieved in this country are very largely of local invention and manufacture.

IN the pre-mechanical age the flail was used to free grain and other seeds from their stalks, and the wind to separate the chaff and light material from the seeds. The first crude threshing machines incorporated a series of mechanically operated flails, and the use of a rotary fan to provide an air blast led to the first seed-cleaning machine, termed a winnower.

In 1788 Andrew Meikle, of Whiterock, East Lothian, England, patented his revolving drum, which worked inside a concave and which combined in one machine the operations of the flail and the winnower. His machine did a lot its predecessors had not done, and combined a striking and a rubbing action to free the seed from the stalk. It then separated the seed, chaff, and

← Machine-dressed red clover seed from the line containing the broken seed illustrated at right. The farmer should not always depend on the seed cleaner to make such a good job from a poor sample.

Chipped and broken seed → extracted in obtaining the sample shown at left. With care at harvest this seed should not have been present in the field-dressed seed.



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"PRIMARY PRODUCTION IN NEW ZEALAND"

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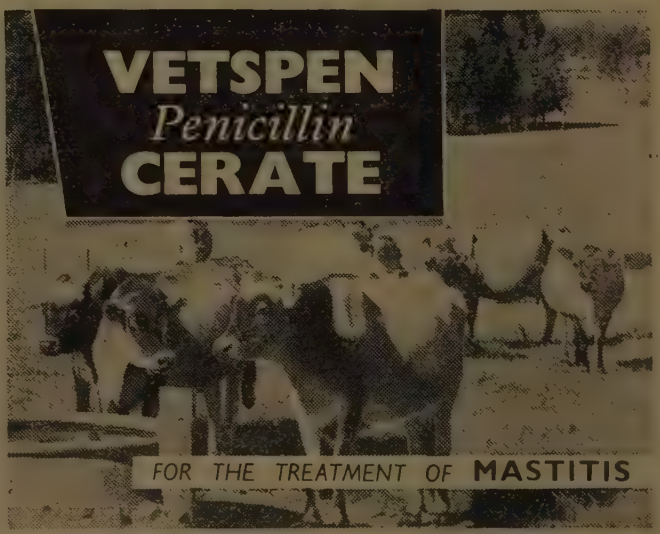

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other small particles from the straw by an agitated screen, finally using air blasts to separate the chaff and other impurities from the seed.

Thus was evolved the threshing machine — particularly suited for handling grains—which was (with modifications) until comparatively recent years often the only method of cleaning grain and other seed. Today the cleaning which is associated with the threshing of the seed is regarded only as a preliminary treatment, the final cleaning or machine dressing being done in central stores in up-to-date seed-dressing plants.

In New Zealand the grass and clover seed industry began with the collection of cocksfoot seed, which was first recorded as being saved at Pigeon Bay in 1854. By 1865 huge orders for the seed were coming forward. The method of harvesting was to cut the cocksfoot with a sickle, dry the cut material on the stubble, and sledge or cart it to a suitable place for threshing by flail or other means.

Eventually there was a demand for some mechanical method of cleaning the seed, and about 1886 a Christchurch firm which had made use of screens in chaff cutters to take out dust and small seeds produced a small machine combining a threshing drum and separating screens which proved to be very suitable for the Akaroa cocksfoot growers. This small portable mill was intended for use on the farm, but it was not long before the firm developed much more elaborate machinery for the seed-dressing stores which now do most of the seed cleaning in New Zealand.

Early this century most New Zealand grass seeds were harvested from older pastures which were mostly mixed pastures with one species predominant, and naturally there were many impurities in the undressed seed.

In August 1912 A. H. Cockayne, at the Dominion conference of the Farmers' Union in Wellington, said:

> The extremely impure nature of much of our local seed in the rough has led to a system of seed cleaning that is unexcelled in any part of the globe. Thus we have the extremely peculiar and interesting position of undressed local seed being probably the dirtiest in the world, while dressed seed of the same lines is, without doubt, unequalled in any seed-producing country so far as freedom from extraneous seeds is concerned.

In 1912 the methods of harvesting and threshing grass and clover differed from the labour-saving methods used today. The English type of threshing mill which was then in general use in New Zealand had not undergone any fundamental changes in design since the first half of the 19th century. It made quite a fair job of cleaning out most of the impurities.

Though the much more recent header harvester uses the same fundamental principles in its operation, it combines in one readily manoeuvrable machine the functions of the reaper and the threshing mill. This combination, with all its advantages, has one drawback—a limit to the space available in which to incorporate the various parts. Thus the sample produced by the header harvester cannot be expected to be as pure as that produced by the much larger threshing mill. Against this the great majority of seed-producing areas are sown today with seed production in mind, and usually only two species—one grass and one clover—are sown in these areas, which are harvested for seed early in their life.

Thus though the header harvester has almost entirely replaced the threshing mill, the effect has been offset by the change in seed-production methods. However, seed-cleaning plants still have a similar task, the removal of weed seeds, other crop seeds, broken seeds, pieces of straw, and other rubbish from the field-dressed seed.

Separation Principles and Devices

In the separation of weed, grass, and clover seeds, dirt, chaff, straw, and other foreign matter, including broken seed, different principles are used according to the impurities present. The varying characteristics of the seeds and foreign matter have been made use of in devising the methods for cleaning the seed. The main characteristics are size, shape, and specific gravity.

The most generally useful device in seed-cleaning machinery is the riddle, which depends on size and shape differences for its usefulness. The perforations in a series of riddles reveal a great variety of shapes and sizes suitable for separating many kinds of impurities. The main riddle types include round and oblong holes punched into sheet zinc, and wire mesh giving square and various oblong openings. Opening sizes range from the equivalent of the smallest seeds harvested to the largest, the range used in any particular plant depending on the types of seeds handled.

Three prime motions used in the operation of riddles are to and fro, up and down, and crosswise. A combination of to and fro and crosswise will give a rotary motion. Again the riddles may be run on eccentrics on a steel spindle, thus combining to and fro and up and down movements to give the seed a jumping motion. In the seed trade such a machine is known as a "jump machine". In addition to the type of motion, riddles may also be run at different speeds and pitches.

Another device making use of size and shape is the cellular cylinder. This, too, may be obtained with a large variety of shapes, sizes, and angles of indentations of cells in the inner surface of the cylinder.

Cellular cylinders are fitted at an angle to the horizontal. As the cylinder slowly rotates material is picked up in the cells, leaving behind in the bottom of the cylinder anything too large to fit into the cells. As the material is lifted upward by the cylinder that of greatest length falls out first and returns to the bottom. Shorter material is lifted higher and when it does fall it is caught in a suspended trough running the length of the cylinder. The position of this trough or tray can be adjusted to make a separation at an earlier or a later stage in the cycle of the cylinder. The material remaining in the bottom of the cylinder works along and is caught at the lower end, and that gathered in the tray is taken away separately.

Thus a cylinder will make separations with great accuracy in material of the same shape in cross-section but varying in length. Such a separation would be impossible over riddles.

In using air currents in a dressing plant advantage is taken of variations in specific gravity, by which chaff, straw, and empty glumes may be separated from sound seed, and lighter seeds such as grasses may be separated from heavier seeds such as clovers. The current of air formerly obtained by blast is now more usually developed by suction. The strength of the current can be adjusted according to the line of seed being cleaned.

A modern machine-dressing plant consists of a number of different types of machines, linked as required into one plant so that any line of seed may be fed into the hopper and go automatically through as many processes as are necessary for thorough cleaning. Sometimes lines will have to go through the same process twice.

The separations made in a line of Italian ryegrass are shown in the illustration on page 564.

Subsidiary Separating Devices

There are a number of subsidiary separating devices which may be required to deal with special classes of seeds or to improve the purity of difficult lines of seed. The dossor is a machine used commonly in the cleaning of clover. It makes use of revolving velvet surfaces on which irregular, flat, and broken seeds are carried up and round seeds roll down.

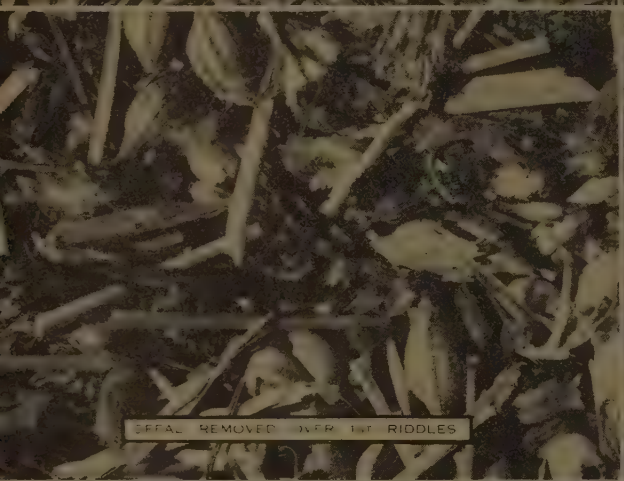
Another less usual but effective device has been incorporated in a machine which is particularly useful for a final process in removing chipped and broken seed from clovers. Magnetism is used to effect separation, and it is necessary to mix a very small quantity of iron filings with the clover seed, the filings adhering to broken surfaces but not to whole seeds.

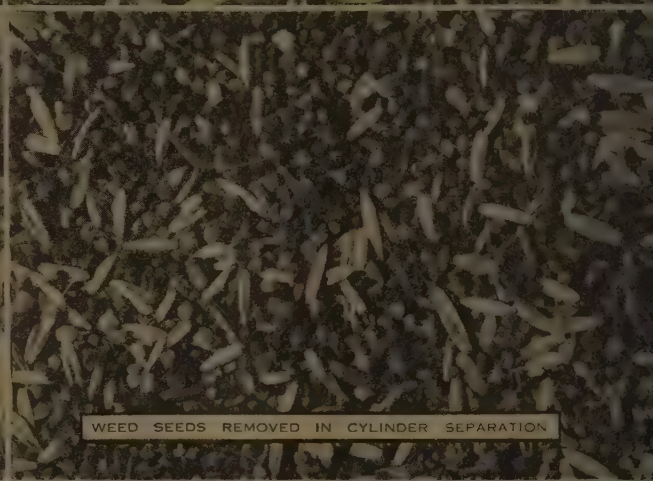
Another machine, by using wind and different specific gravities of seed, is

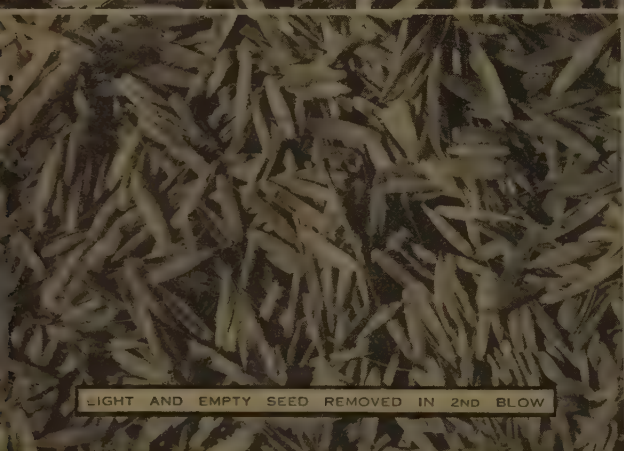
MACHINE DRESSING OF ITALIAN RYEGRASS SEED

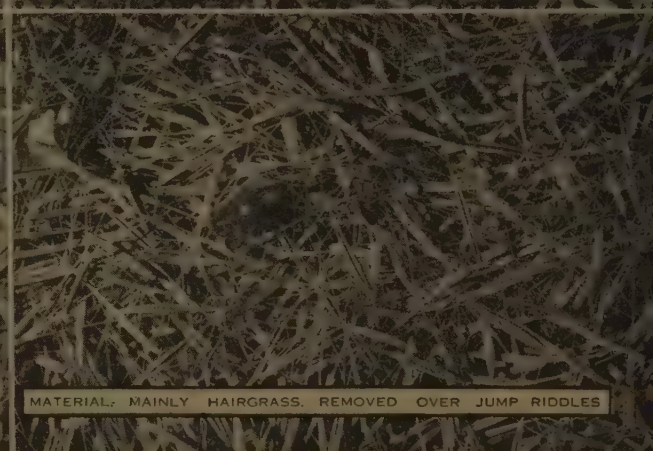
FIELD-DRESSED SEED FOR MACHINE DRESSING

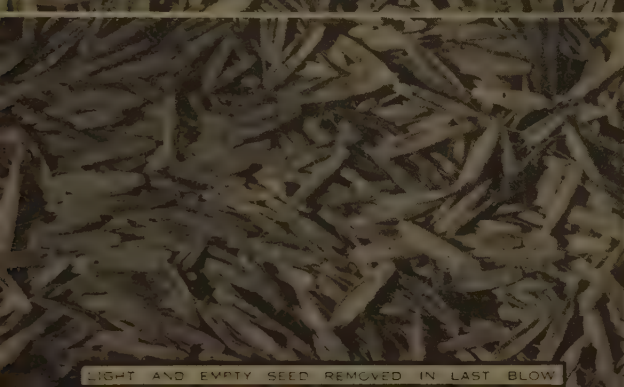
OFFAL REMOVED IN 1ST BLOW

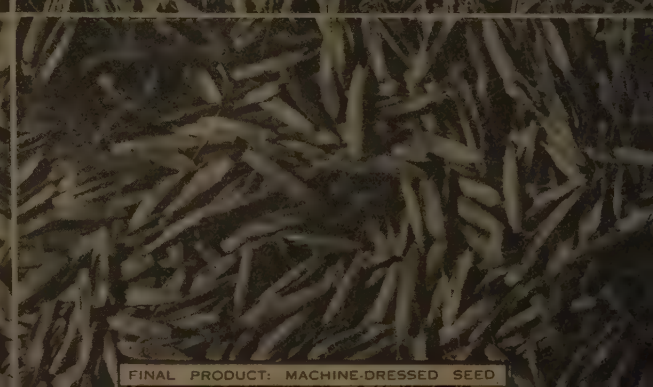

OFFAL REMOVED OVER 1ST RIDDLES


WEED SEEDS REMOVED IN CYLINDER SEPARATION


LIGHT AND EMPTY SEED REMOVED IN 2ND BLOW


MATERIAL, MAINLY HAIRGRASS, REMOVED OVER JUMP RIDDLES


LIGHT AND EMPTY SEED REMOVED IN LAST BLOW


FINAL PRODUCT: MACHINE-DRESSED SEED

often able to separate seed of similar size but different weight which riddles and cylinders might not be able to separate. In this machine, known as a specific gravity separator, a current of air passing upward through a perforated jumping table keeps the seed continually in motion and makes a number of very fine separations based on variations in the specific gravity of the material being handled.

Saddlers' felt or similar blanket material is sometimes used to separate "clinging" seed from other types of seeds. The material is suspended on a horizontal plane above the riddles of a jump machine. The action of this machine throws the seed against the under side of the material. Seeds such as sweet vernal adhere to the matted surface and other seeds fall back to the riddle. The blankets require cleaning periodically if they are to retain their effectiveness.

The hummeller is used to remove husks from seed or grain and to clip the long ends off oats. It is fitted with cutting knives or brushes according to the work to be done. At the outlet an air suction draws away all light material rubbed off by the hummeller.

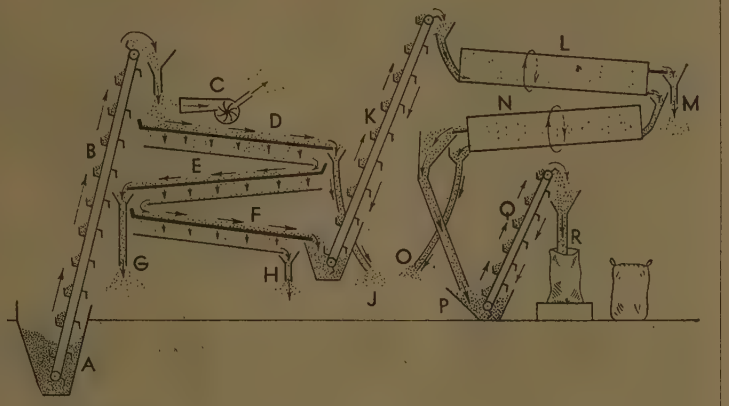
Brushes may also be used as other adjuncts to the seed-cleaning process. They may be used underneath the riddles or screens to prevent their becoming blocked with seed, so that uniform work may be ensured throughout the cleaning operation. For the shelling of some seeds such as Yorkshire fog the brushes separate the shells from the kernels, the cylinders lift the kernels away, and an aspirator removes the husks by suction. Again, brushes may be used for breaking up double heads of cocksfoot as well as for brushing up a sample to make it flow better when it is being sown, or they may be used in breaking up soft dirt in subterranean clover seed so that the dirt may then be removed.

Polishers make use of brushes working over a wire concave. They are used by seed-dressing firms to break up small particles of dirt in clover, particularly white clover. Suction draws off the light material rubbed off by the polishers. The polishers may also be used to decrease the percentage of hard seeds in clovers.

A "bounce" machine uses the resilience of sound pea seeds to separate them from damaged seeds and from pieces of dirt of similar size. The material to be cleaned is bounced on to a series of plate-glass surfaces which are set to allow a separation according to the resilience of the material.

An electronic "eye" is used to make a separation according to seed colour. Thus discoloured and weathered peas can be separated from sound peas, and yellow seeds of linseed from brown seeds. Each seed comes individually under the "eye" and is graded according to colour.

Photographs on opposite page by Green and Hahn.



Separations Made in Cleaning a Line of Seed

The number of separations made in cleaning a line of seed will depend both on the kind of seed and its condition before machine dressing begins. The accompanying flow diagram, though not that of any particular machine and not giving the order in which the component parts may be used or the numbers of the parts, illustrates a link-up of elevators, blast, riddles, and cylinders, which are essential in most cleaning operations. The following is a description of the labelled parts:

A—Hopper for field-dressed seed, usually built with the top just above floor level and large enough to hold several sacks of seed.
B—Elevator to lift field-dressed seed to machine.
C—Air suction to remove light chaffy material.
D—Top or scalping riddle; the largest impurities in the line are retained on this riddle, the balance passing through it.
E—Second riddle, with similar function to the top riddle, but separating impurities more nearly the size of the seed being cleaned. This riddle may be used to remove the largest seed or to carry over the main run of seed and allow only the smallest seed to pass through with small impurities.
F—Third riddle; the seed being cleaned, with impurities of similar size, passes over this riddle, smaller impurities passing through it.
G, H, and J—Spouts at which the separations made by riddles E, F, and D respectively are collected.
K—Second elevator, lifting riddled seed to cylinders.
L—First cylinder, which separates material of shorter length than the seed being cleaned, lifting it into the cylinder tray.
M—Discharge point for material separated in first cylinder.
N—Second cylinder, which separates material of greater length than the seed being cleaned. The dressed seed is lifted into the cylinder tray while the separated material passes along the bottom of the cylinder.
O—Discharge point for material separated in second cylinder.
P—Hopper into which machine-dressed seed is delivered.
Q—Elevator lifting machine-dressed seed to bagger.
R—Bagger for machine-dressed seed.

A Christchurch firm which has specialised in the production of seed-cleaning machinery from early days supplies not only much of the New Zealand market but exports seed-cleaning machinery to Australia, Scotland, and Ireland. Improvements continue to be made not only in the design of existing machinery but also by the invention of devices, as for instance a patent for the removal of flat seeds from round seeds in the dressing of clovers and brassicas.

Seed Store Procedure

Individual stores have their own methods and techniques, but certain practices are general in all stores. To understand the seed store procedure it is necessary to follow a line of seed through the store from the time it enters to the time it leaves.

All seed coming into store is first weighed in the wagon or truck on a weigh bridge, the tare weight of the conveyance being deducted to give the

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weight of the bags and contents, or the gross inward weight. The net inward weight of the seed is that obtained by deducting the weight of sacks from the gross inward weight. As the wagon is unloaded and a tally made of the number of sacks every bag is sampled to see that all sacks are similar in their contents. The line is then stacked to await its turn for machine dressing. Various methods may be used in stacking, but nearly all firms now use electric hoists.

Should the line be one with a marked variation in quality, due perhaps to a different pasture composition or treatment of the area or to threshing at different times or under different conditions, it is advisable for the farmer to keep the different parts of the line separate and to advise the firm accordingly. The variation may be noticed by the storeman at sampling, when the line comes in, but if it is overlooked and the sacks are not marked, dressing difficulties are created, as a separate dressing of each part cannot be carried out. Also sacks with obviously dirty contents or sacks containing seconds should be marked before they leave the farm so that they will be easily identified and handled separately in the store to ensure uniformity in dressing.

Lines of seed being dressed for clients are usually treated in the order in which they come into the store. When the line is taken down from the stack for dressing the seed is tipped into the hoppers and the sacks put aside for cleaning. An efficient sack cleaner is a very necessary machine in a seed-cleaning store. All types of seeds cling to the sacks inside and out, particularly seeds such as hairgrass, Italian ryegrass, sweet vernal, burr clover, and other rough seeds. A good sack cleaner removes all these seeds and the sacks may then be used as clean "once-shot" containers for seed, seconds, offals, meals, and other purposes.

When it comes off the dressing machine the machine-dressed seed is generally put into new sacks, each containing a standard weight of seed. After being sewn the sacks are branded with the identification line number of the firm and a description of the seed. With certified seed official samples are then drawn and the sacks are tagged and sealed. The seed is then ready for further storage, which means restacking, or for removal from store. The outward weight is the net weight of machine-dressed seed. The various seconds and offals extracted are also bagged and their descriptions and weights recorded.

Seconds and Offals

Farmers frequently have the impression that a lot of good seed goes out in the seconds or offals at machine-dressing time. Seconds is the name usually given to the best of the dressings taken from the firsts or machine-dressed seed, and offals refers to the other grades of seeds, weeds, and rubbish which are extracted at machine dressing.

Field-dressed clover seed in the receiving bin of a dressing plant.

An examination of samples of the various separations will show that in seconds and offals there is little that could be used. However, sometimes the seconds consist of seed which would warrant further dressing or disposal as seconds. This seed is not as a rule mixed with the firsts, as its purity may not be so high and it may spoil a good line of firsts, but sometimes if of similar quality the seconds may be run back through the machines into the firsts. An example of this is provided by shelled cocksfoot the seconds of which usually have purity and germination as good as those of the firsts and which are run back to increase the bushel weight of the line.

There are instances where two varieties of seed, such as perennial ryegrass and white clover, are harvested together. When this happens the seed dresser aims at getting the most of both varieties by dressing, say, the perennial ryegrass, and extracting most of the white clover in one line, which is then dressed separately on the clover machines. Again, a reasonably pure line of white clover may be separated from a mixture of white and suckling clovers without detracting from the value of the mixture still remaining.

In any event, seconds which may be usable are kept by the dressing firm for instructions from the owner of the seed. Genuine offals, however, have to be dumped or destroyed. Though some types of offals have food value when sterilised, ground, and mixed in stock meal—a practice adopted during the war to utilise the feed value of an otherwise waste product—better foodstuffs are now readily available for stock meals and the practice has generally ceased.

Seeds Cleaned in New Zealand

A great variety of grass and clover seeds is produced on New Zealand farms and cleaned by New Zealand-made and imported machine-dressing plants.

In the cleaning process each variety of seed has its own peculiarities and difficulties. There are impurities which owing to size and shape will obviously be important when present in certain seeds but which are of no moment in others. Consequently it is desirable to discuss separately each of the seeds more commonly handled.

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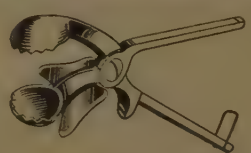

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GRASS AND CLOVER SEED . . .

Perennial ryegrass: As the very high purities indicate, the cleaning of perennial ryegrass presents few difficulties. However, it is possible to strike trouble in some lines because of the presence of goosegrass which has its awns broken off or is partly or completely shelled. If the awns are left on by the farmer during harvesting (by light threshing), there is generally little difficulty in removing the goosegrass. Farmers with goosegrass in their perennial ryegrass seed-production areas should therefore take every care to avoid damage to this seed during threshing. Hard threshing also breaks up straw into small pieces, some of which, being similar in size and shape to ryegrass seed, may prove difficult to remove in dressing. Cocksfoot, English trefoil in the shell, sweet vernal, and hairgrass are other impurities which occasionally cause difficulty in dressing perennial ryegrass.

Italian ryegrass and short-rotation ryegrass: As Italian ryegrass and short-rotation ryegrass are harvested from young pastures only, there are normally fewer impurities present in the paddock than with many other seeds. Those most likely to give trouble to the seed cleaner are goosegrass and hairgrass. Well developed ribgrass, unshelled white clover, wild oat, and sweet vernal are other impurities which are difficult to remove entirely from Italian ryegrass.

Cocksfoot: In the cleaning of the main grass seeds perhaps the least satisfactory job is made of cocksfoot because of the great difficulty in removing inert matter consisting mainly of husks which do not contain kernels. Many lines can be improved in this respect by increasing the blast or suction, but care should be taken not to overdo the treatment and so remove good seed. Small perennial ryegrass seed, which is very similar in size and shape to cocksfoot, is also difficult to separate. Cocksfoot seed should therefore be harvested from areas as free as possible from perennial ryegrass. Minor impurities in cocksfoot are goosegrass, ribgrass, Yorkshire fog, and catsear.

The dossor, a finishing machine for clover seed.

Crested dogstail: In crested dogstail seed Yorkshire fog may be the worst impurity, particularly when it is small and becomes shelled, as it may then be almost impossible to separate. Other impurities difficult to eradicate are sweet vernal, hairgrass, white clover, chewings fescue, and small perennial ryegrass.

Chewings fescue: The most objectionable weeds encountered in dressing this seed are catsear, sweet vernal, small ryegrass seed, and hairgrass. Catsear is the worst of these, as, being the same shape, size, and weight as fescue, it is frequently not removed by the riddles or by the cylinders.

LIST OF BOTANICAL NAMES OF PLANTS MENTIONED IN ARTICLE

Common name	Botanical name
Alsike clover	*Trifolium hybridum*
Bindweed	*Convolvulus arvensis*
Browntop	*Agrostis tenuis*
Buck's horn plaintain	*Plantago coronopus*
Burr clover	*Medicago hispida* and *M. arabica*
Californian thistle	*Cirsium arvense*
Catsear	*Hypochaeris radicata*
Chewings fescue	*Festuca rubra* var. *commutata*
Chickweed	*Stellaria media*
Clustered clover	*Trifolium glomeratum*
Cocksfoot	*Dactylis glomerata*
Crested dogstail	*Cynosurus cristatus*
Dock (broad-leafed)	*Rumex obtusifolius*
Dock (curled)	*Rumex crispus*
Dodder	*Cuscuta epithymum*
English trefoil	*Medicago lupulina*
Falcatula	*Falcatula ornithopodioides*
Goosegrass	*Bromus mollis*
Hairgrass	*Vulpia* spp.
Hoary cress	*Cardaria draba*
Horehound	*Marrubium vulgare*
Italian ryegrass	*Lolium multiflorum*
Lucerne	*Medicago sativa*
Milk thistle	*Silybum marianum*
Nassella tussock	*Nassella trichotoma*
Ox-eye daisy	*Chrysanthemum leucanthemum*
Perennial ryegrass	*Lolium perenne*
Rape	*Brassica napus*
Red clover	*Trifolium pratense*
Ribgrass	*Plantago lanceolata*
Short-rotation ryegrass	*Lolium multiflorum* x *L. perenne*
Sorrel	*Rumex acetosa* and *Rumex acetosella*
Striated clover	*Trifolium striatum*
Subterranean clover	*Trifolium subterraneum*
Suckling clover	*Trifolium dubium*
Sweet vernal	*Anthoxanthum odoratum*
Timothy	*Phleum pratense*
Toadrush	*Juncus bufonius*
Vetch	*Vicia* spp.
White clover	*Trifolium repens*
Wild oat	*Avena fatua*
Wild turnip	*Brassica campestris*
Wireweed	*Polygonum aviculare*
Yarrow	*Achillea millefolium*
Yorkshire fog	*Holcus lanatus*

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Timothy: An increasing quantity of timothy seed is being harvested in New Zealand mainly in Southland and Otago. Generally the worst impurity in this seed is Yorkshire fog. White, alsike, and suckling clovers are also hard to remove during dressing, and management of areas producing timothy seed should aim at the elimination of these plants as much as possible. Timothy is often appreciably shelled during dressing, but this seed seems to germinate just as satisfactorily as unshelled seed.

Browntop: Two of the worst impurities in browntop are toadrush and yarrow, which are practically impossible to eliminate. Other minor impurities are chickweed, white clover, English trefoil, and hairgrass. An impurity sometimes present and impossible to remove altogether is buck's horn plantain. A large quantity of straw is present in some lines. This is easily separated, and as dressing charges are based on inward weights, it may pay the farmer before sending the line into store to put it over his header to eliminate some of this waste material.

White clover: As the main clover seed produced in New Zealand white clover has always received particular attention from seed-dressing plants. As with most other seeds a high standard of purity is generally obtained. If suckling clover is present in quantity in the field-dressed sample, however, it is not possible to make a clean separation at machine dressing and there must then be heavy dressing losses if white clover seed with a reasonably high purity is desired. After suckling clover the worst impurities are sorrel (with the wings removed), shelled fog, clustered clover, timothy, and falcatula.

Cowgrass and Montgomery red clover: The worst impurity in red clover seed is damaged red clover seed itself. If the farmer during his threshing sets his machine too hard or if he threshes his crop out of condition, he will certainly get a higher proportion of chipped and broken seed. Redressing of such seed may cause to show up even more broken seed which had been damaged at threshing. Badly broken seed can be removed fairly readily, but slightly chipped seed will give most cleaning plants a problem that they cannot handle to either their own or the grower's satisfaction, as it is practically impossible to eliminate this seed. Ribgrass, sorrel, and dock seeds are impurities which are also most difficult to separate completely by machine dressing. The presence of dock seed in red clover has caused complaints from the English market. Other impurities are white clover and dodder.

Subterranean clover: A small area of subterranean clover is harvested in New Zealand, principally in Marlborough. Owing to the method of harvesting, small stones and soil particles are very common impurities in subterranean clover seed, but though they are troublesome, they can usually be separated at machine dressing. Chipped and broken seed may be a bad impurity; this is caused by hard threshing in freeing the clover from the cob. Other impurities which may be difficult to remove entirely are wild turnip, vetches, rape, and striated clover.

A grass seed-dressing plant, showing cylinders.

Lucerne: Probably the worst impurities in lucerne are ribgrass, docks, and red clover. Other impurities which at times are hard to remove altogether are wild turnip, ryegrass, goosegrass, hairgrass, and striated clover.

Purity Standards

In the seed trade the main basis of dealing is on a minimum requirement of 98 per cent. purity and 90 per cent. germination (with the exception of cocksfoot). Generally there is little consideration on the export market for lines of seed which fail to meet these requirements, though germination may depend on seasonal conditions. With the main seeds purities of 99 per cent. and over are very common.

Though emphasis has been laid on the good job done by most seed-dressing plants, it is as well for the farmer to remember that a line of seed with a purity of 99.8 per cent and containing as little as 0.1 per cent of seed of a particular weed or weeds may be unsafe to sow and may be prohibited from importation into other countries. For instance, seeds containing even a trace of bindweed, hoary cress, or dodder are prohibited from entry into Australia, the United States of America, and Canada, and lines containing Californian thistle are prohibited from entry into Australia and the United States. Again, nassella tussock, ox-eye daisy, and milk thistle are totally prohibited impurities in seeds for Australia.

Other common weeds which if present in excess of a restricted quantity will prevent the entry of seeds into Australia are horehound, wireweed, and ribgrass, depending on the seriousness with which the impurity is viewed.

Therefore it is necessary to realise not only that a high purity is important, but that freedom from particular impurities may also be essential.

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Capacity of Plants and Dressing Losses

Owing to the different arrangements and types of machinery used by different firms, as well as the wide differences in lines of field-dressed seed, there is no fixed rate for the dressing of any particular grass or clover seed. However, one typical large plant when dressing ryegrass puts into the machines about 20 to 30 bushels per hour of field-dressed seed and when dressing clover about 500 lb. to 600 lb. per hour. The outward weight, of course, varies to a great extent, and may be lower than 20 per cent or higher than 80 per cent of the inward weight, depending on the impurities taken out.

As has been explained it may be necessary to put a line over the machines twice, and this naturally halves the dressing rate. Whatever the rate is, it should be remembered that machine dressing is a process which cannot be hurried but must be done thoroughly if it is to be satisfactory.

Effect of Certification

Now that the bulk of the seed dressed is either certified in the paddock or entered for certification in store after dressing every care is necessary to ensure that there is no chance of contamination at the machine-dressing stage.

In the larger stores the procedure may be simplified; for example, when ryegrasses are being dressed one machine will perhaps handle only lines of perennial ryegrass which are to be entered for certification by type test, whereas another machine will take only seed which has already been certified in the paddock. Another machine will deal with lines of certified Italian ryegrass. There is then no chance of different types of ryegrass being mixed.

However, all firms do not have sufficient plant to be able to do this, but they simplify matters by dressing, say, all lines of available Italian ryegrass first. Then the machine is given a very thorough cleaning and uncertified perennial ryegrass lines may be put through. After another thorough cleaning, the certified perennial ryegrass lines are dressed.

Because so many of the total seeds dressed are certified, it may be said that all dressing firms now keep the rules of certification in mind when they are cleaning the seed. The result is that there is every co-operation between the seed-dressing firms and the officers of the Extension Division of the Department of Agriculture, which makes for easier working on both sides.

Extent of Seed Cleaning in New Zealand

Seed-dressing stores are usually situated at all centres of seed-growing areas. The number at any one centre may vary from a single plant to six or more. Of the 91 plants in operation 69 are in the South Island and 22 in the North Island. In addition 14 mobile or portable seed-cleaning outfits dressing grain and small seeds work from farm to farm in the main seed-growing areas of the South Island.

The Human Element

The quality of the work done by seed-cleaning machinery depends finally on one thing—the efficiency of the men operating the machines. An experienced storeman with the ability to sum up a line and gauge what will be required in the dressing process is the first essential. Then the men in

The finishing section of a ryegrass seed-dressing machine.

The final product: Stacks of machine-dressed seed awaiting shipment or local disposal.

charge of each machine require long experience in the handling of their machines, in the adjustment of riddles and cylinders, and in the degree of blast or suction to apply as well as in the choice of the correct size of riddle or cylinder for the seed concerned. Owing to the great variation in the composition of field-dressed seed, no two lines can be treated exactly alike. This calls for good judgment on the part of operators.

It is not only in the operation of the machines that good judgment is required; ability to repair machinery and make up and improve suitable parts on the job is another requirement of a good storeman. Again, the way in which machines are set up, that is, the combination of riddles, cylinders, etc., and the part played by machines such as the dossor, all call for good judgment on the part of the storeman. The very high standard generally of the work done in seed-dressing stores shows that the men responsible are doing an excellent job.

The Farmers' Part

This article has been concerned mainly with the work of actual machine dressing and not with the harvesting and other farm operations leading up to the production of the field-dressed seed. This aspect has been dealt with in the articles which have appeared in the "Journal" on the production of each of the main varieties of seed. However, it is not out of place to mention some of the principal ways in which a farmer may make the work of the seed cleaner easier and so improve the quality of his own line and reduce the cost of dressing to himself.

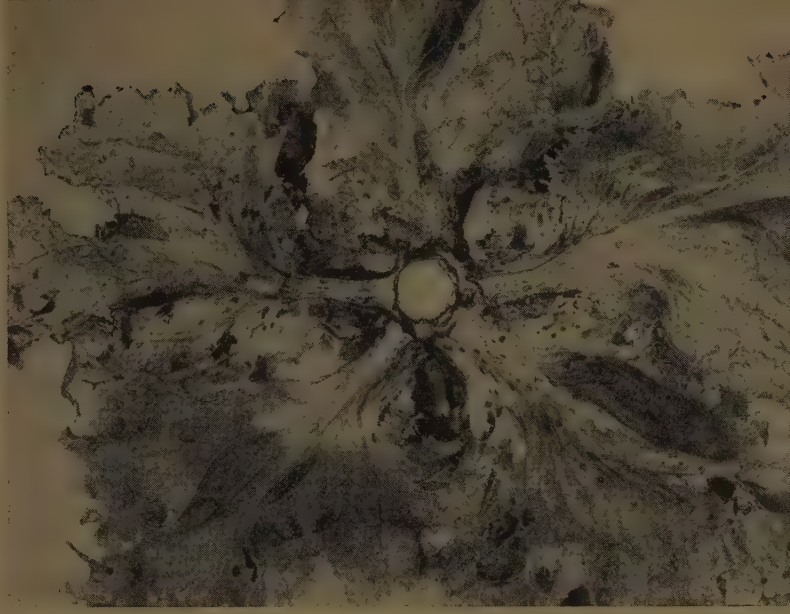
In the first place the advice of a leading member of the seed-cleaning industry is sound: "Leave the seed as much as possible as nature produces it". That is, it is never wise to thresh too hard and possibly knock the awns off seeds such as goosegrass, hairgrass, or Italian ryegrass, or damage and chip clover seed in trying to get it out of the cob. Seed that has been knocked about, whether it is the impurity or the actual variety to be dressed, is all the harder to dress. This applies to all seeds. On the other hand too much straw and seed stalk should not be left in the sample, as this merely increases dressing costs needlessly.

Sometimes seed comes into store badly damaged, owing probably to ignorance of correct harvesting technique. The only advice that can be offered to avoid this is to follow carefully at harvest time the instructions of the manufacturer of the header harvester and to seek advice if in doubt. At harvest time the farmer should keep sampling and examining the seed at intervals throughout the day, as changing atmospheric conditions may affect considerably the necessary header harvester settings

Before seed is sent in to be cleaned it should be thoroughly dry. Damp seed is only a nuisance in store, as it is difficult to dress. It is also lowered in value because of discolouration and musty smell and it may even heat or char in store. If a firm knows that the seed is damp and is prepared to deal with it as a salvage operation, this can be arranged with the farmer. Whatever the cause, no seed should be sent into store damp unless the merchant is aware of the fact and is prepared to deal with it.

The production of good seed starts from the preparation and sowing of a paddock. Everything possible should be done to keep the paddock clean by sowing under the best conditions, by grazing the paddock in the way best suited for the seed to be saved and for control of weeds, and by harvesting the seed in the best manner. In other words, clean seed production should be regarded as a specialised job under good farm management conditions so that the end product, the machine-dressed seed, might be of the highest quality.

Ringspot Disease of Lettuce



The under side of a lettuce attacked by ringspot. This is the part which is usually first affected by the disease.

RINGSPOT is a serious problem for growers of winter and spring lettuces in Canterbury and has caused considerable loss and at times almost complete destruction of the crops. Several experiments previously carried out at Christchurch on growers' properties had resulted in only partial control of the disease. In 1956 newer fungicides and techniques were incorporated in an experiment which is described with its results in the following article.

By L. C. HURNDELL, Horticultural Instructor, Department of Agriculture, Christchurch, and H. C. SMITH, Mycologist, Plant Diseases Division, Department of Scientific and Industrial Research, Lincoln

LETTUCE ringspot (also called rust) is caused by the fungus *Marssonina panattoniana*, which was first identified in New Zealand by Brien (1939). However, ringspot probably occurred in New Zealand long before then. Over the past few years the disease has spread so that most of the lettuce-growing areas in New Zealand are affected.

In Canterbury ringspot is a serious disease of early lettuces, particularly in the Port Hills areas. Spraying has been the main control measure, but it has not been successful for several reasons. First, the material previously recommended (copper sprays) is too damaging to the plants; secondly, growers did not spray until the disease was rampant; and thirdly, growers did not adhere to recommended strengths or use satisfactory equipment.

As field experiments to control ringspot carried out on growers' properties in Canterbury over the past 3 or 4 years were never wholly successful, an area suitable for a controlled field experiment was selected. This gave scope for better techniques and adequate supervision.

Symptoms of Disease

The first visible signs of ringspot are small, yellowish-brown spots on the leaves which may coalesce into larger, irregular, brown patches of dead tissue which in time fall out, giving the plants a ragged, shot-hole appearance. The under sides of old leaves appear to be attacked first, and on the under sides of the main ribs the infection appears as yellowish sunken depressions which turn slightly pink as the infection ages. If the infection becomes severe, the heart leaves may be attacked at almost the same time as the outer leaves, but usually it is the outer leaves which are attacked first.

When conditions are suitable the disease appears in small scattered patches in a field of lettuces. These rapidly spread until they coalesce into large areas and at this stage it is practically impossible to control the disease. The rate of spread depends largely on the prevalence of rain and the time that plants remain wet, and the cool, wet conditions of late winter and early spring favour the development of the disease. At Christchurch the disease does not occur during summer, autumn, or early winter, probably because of lower rainfall and lower humidity.

Lettuces which become infected in the early stage of growth rarely develop a saleable head. If the attack is severe, they remain stunted and ragged and growth is reduced. However, if a plant has reached a good size before infection occurs, and if infection is not severe, there is a good chance of obtaining a marketable head. A crop has been known to reach the harvesting stage free from disease and then by an attack of ringspot be made largely unmarketable.

Ringspot will attack at any stage of the plants' growth. Seedlings may be killed completely if they are severely infected.

Field Hygiene

In market gardening field hygiene plays a big part in the control of disease, because disease can arise from infected plant residue of previous crops.

Ringspot disease is also seed borne and sometimes this may be the initial source of infection.

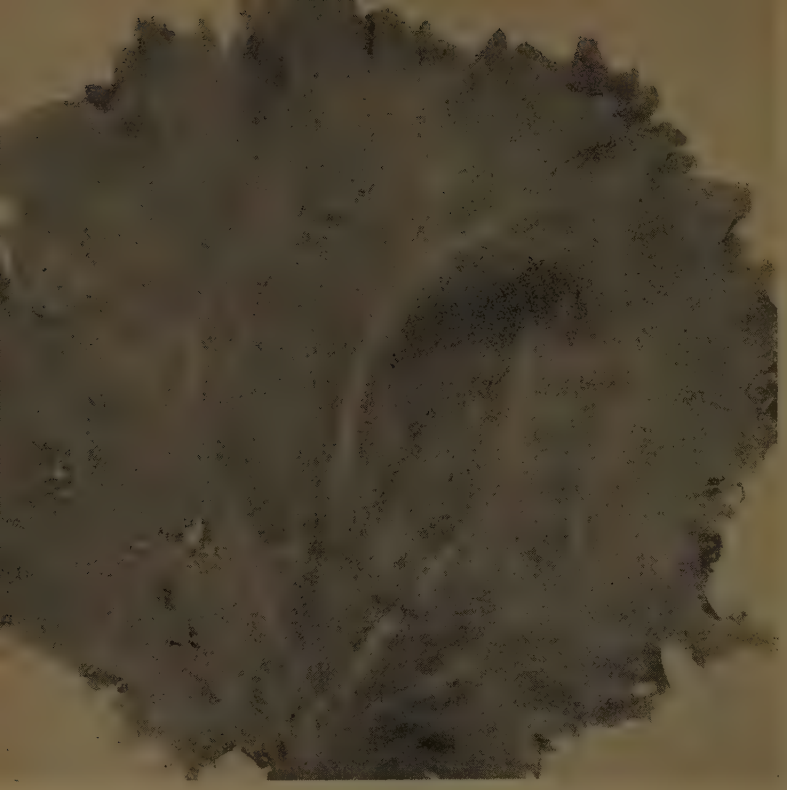
The destruction of all residue once the crop is finished is of paramount importance. Particular attention should be paid to the edges of areas, as these seem to be the places where the residue is not completely ploughed in and where infection arises.

Where lettuces are grown in close succession on the same area the disease is liable to be more severe than where crops are rotated. This proves that infection is carried over in the soil. Though the spores probably do not live long in the soil, the fungus probably can remain viable in the partially decayed crop residues for many months.

Field Trial with New Fungicides

As past control measures were not satisfactory, a new trial to compare old fungicides with more recently developed ones both as sprays and dusts was carried out at the Vegetable Section of Crop Research Division, Department of Scientific and Industrial Research, Lincoln. The trial consisted of 40 plots, each containing 28 plants. There were eight treatments, including two check (non-treated) plots, and each treatment was replicated five times.

The treatments compared a 50 per cent preparation of captan and a 75 per cent. preparation of thiram, each made up as sprays (at 2 lb. to 100 gallons) with a 50 per cent prepara-



A lettuce leaf damaged by ringspot.

tion of copper oxychloride spray (5 lb. to 100 gallons) and dusts of the same materials mixed with very finely ground talc to give a 6 per cent commercial strength. Captan and thiram are recently introduced preparations and copper oxychloride has been used in the past.

To encourage the spread of ringspot and also ensure even distribution over the area the disease was introduced to the trial plots by inoculation, and at intervals throughout the trial irrigation was used to aid the spread of the disease. From 21 August to 19 October 1956 the fungicides, dusts and sprays, were applied seven times, at 10-day intervals.

By the middle of October the disease had spread over the entire trial area. The plants in the check plots were severely stunted with leaves withered and distorted, as were those of a large number of plants in the plots treated with copper oxychloride. In the plots treated with captan and thiram particularly the former, infection showed only on the tips of the outer leaves, the plants having reached a good size before becoming infected.

Harvesting and Grading of Plants

As practically all the plants in the trial had some ringspot infection, it was decided to grade them to discover the total number of plants which were marketable. Results were as follows:

Plots treated with	Marketable plants (out of 140)
Captan dust	109
Captan spray	102
Thiram dust	100
Thiram spray	65
Copper oxychloride dust	40
Copper oxychloride spray	71

All the plants from the check plots were rejected.

Results of Trial

This new trial was the most successful of all field investigations into control of ringspot and showed that it is possible to gain excellent control under severe conditions.

As this trial suffered conditions far in excess of normal, the results are a good indication of the superiority of the newer fungicides, both sprays and dusts, though the thiram spray treatment was not as efficient as the dust. This was probably due to a non-wettable power being used instead of a wettable powder. This error was discovered too late and it is thought that thiram spray treatments would be more effective as a wettable powder.

With captan and thiram there was no apparent phytotoxic effect on the plants and no visible residue. With copper oxychloride, however, small amounts of residue were noted even after heavy rain.

In this trial the dusts were at least equal to the sprays. As dusts can be applied more easily than sprays, particularly under winter and early spring conditions, and save much time and labour, they may be more satisfactory for the control of several fungous diseases of vegetables. Another point in their favour is that they can be easily blown in under a lettuce plant, where ringspot usually attacks first, whereas it is difficult to spray a lettuce properly because it is low growing. It is important that the active material in the dust should be wettable to ensure that the material spreads and adheres to the leaf in the presence of moisture and that it will not float off as would a non-wettable material.

As dusts are better applied when the foliage of plants is damp, they can be applied during damp weather but not in actual rain. They thus have a distinct advantage over sprays, which can be applied only to dry plants and during fine weather. Dusts seem to be the ideal method of control for ringspot disease on lettuce under normal winter and spring conditions.

Though treatments were applied every 10 days, this time is not a rigid factor, as applications, whether as sprays or dusts, depend entirely on weather, particularly during winter and spring. It is considered that 10 days between applications would be the maximum interval under normal conditions.

Recommendations

The results of this experiment indicate that recommendations for the control of ringspot in lettuce can be made as follows:

1. Apply captan or thiram as a spray (2 lb. to 100 gallons) at 50 to 100 gallons per acre or as a 6 per cent dust at 15 lb. to 30 lb. per acre at 10-day intervals when weather conditions are suitable for ringspot development, but before the first signs of the disease are evident.

2. The first application should be made within 2 days of more than ½ in. of rain after planting. Subsequent applications will depend on weather, but should be made after each fall of rain. At the first sign of ringspot, applications should be continued at 10-day intervals.

3. For effective control application must be thorough to ensure complete coverage. Particular attention should be paid to the under sides of young plants.

4. It is essential to keep weed growth at a minimum, as a weedy crop is more vulnerable than a clean one.

5. Adherence to the recommended dosage when mixing fungicides is important, as is the use of wettable powders. This applies to both sprays and dusts, especially the latter.

The Home Garden in July

By A. G. KENNELLY,
Horticultural Instructor,
Department of Agriculture,
Dunedin

IF the weather is comparatively mild and sunny in July as the days lengthen noticeably, many keen home gardeners become eager to get out into their gardens to plant and sow. But the ground is too cold in most districts in July for planting any except the hardiest plants, and only small and to some extent speculative sowings of hardy vegetables should be made where situation, soil tilth, and drainage are favourable.

SOWING, ground preparation, and to only a slightly less extent planting should be governed by the state of the ground and climatic conditions. It is not advisable to sow unless the soil can be worked down to a fine, friable tilth; soil is usually in the right condition if it does not stick to the soles of the boots when walked on.

In the well planned garden of adequate size a considerable area of ground should have been dug or trenched in autumn or early winter and left rough. The first thing to be done before sowing in spring is to fork over the top spit and break it down thoroughly. This forking provides a good opportunity for digging in lime or artificial fertiliser; organic manures such as stable or farmyard manures are best deeply dug into the ground in late autumn or early winter.

Light soils require only a shallow forking, as they break down well and readily crumble to a fine tilth if they are in condition for sowing. Heavy soils are thoroughly loosened and aerated best by breaking the sods with the back of the fork. The operator should work backward so that he does not walk on the loosened soil.

Firming and Raking

Firming requires a good deal of judgment. Soils that are heavy or only just dry enough require care to ensure they are not firmed too much; hitting the earth with the back of the spade is sometimes sufficient, but soil that is in best condition for sowing should be firmed by shuffling over it with the feet. Merely walking across the plot is not advisable, because usually the soil is then made too firm. It is important to remember that the object of firming is to pack, not consolidate, the soil particles.

[*Green and Hahn*

A small amount of speculative sowing may be done in July. Boards should be used to distribute the gardener's weight and so avoid overfirming the soil beside seed drills.

The final work required to be done on the seedbed is the removal of loose stones and rubbish and reducing the surface of the soil to the finest tilth possible and at the same time levelling it. This is done with the fine-toothed garden rake, the teeth of which should penetrate only to the actual depth the seed is to be sown. Heavy soils must be closely observed and sowing delayed if the soil is at all sticky and the correct tilth cannot be easily obtained.

Seed Drills

Probably the most convenient tool for making the seed drills is the ordinary swan-necked hoe. In drawing a drill with the hoe the blade should be tilted on its edge and only the corner used. By using short, frequently repeated strokes the drill can be drawn straighter and its depth more carefully regulated than if long continuous strokes are used. The maintenance of correct, even depth is very important, because variations are likely to cause irregularity of germination which will result in difficulty in thinning or blank spaces in the rows.

Marking the Rows

There are various ways of marking the rows. Some home gardeners use on each end of their garden line a peg or stick about 2 ft. long and marked at 6 in. intervals. This method is quite good, but a 6 ft. to 10 ft. length of 1½ in. x 1 in. or 1¼ in. x ¾ in. batten marked at 6 in. intervals and having each foot number painted will be found very useful both for marking off the distance between the rows and the distance between the plants in the row.

The garden line is an important piece of garden equipment. Strong string or a good light cord is preferable and it will be more useful if it is marked or knotted at intervals for the first few feet or yards according to the measurements most often used. A good garden line is worth treating with a preservative, such as copper naphthenate, as it will then last for many years even if left out in the garden.

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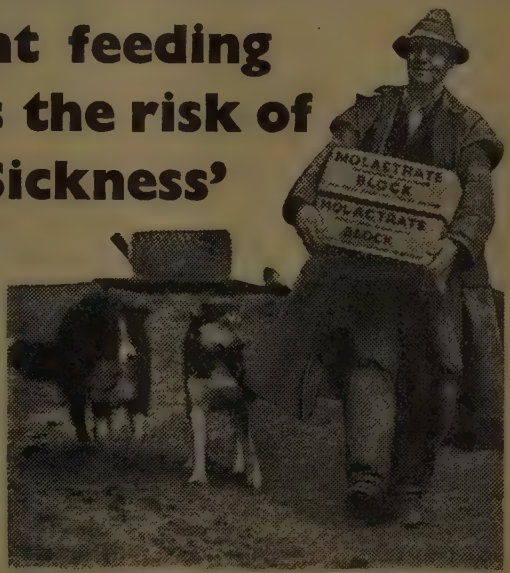

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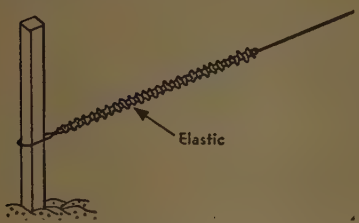


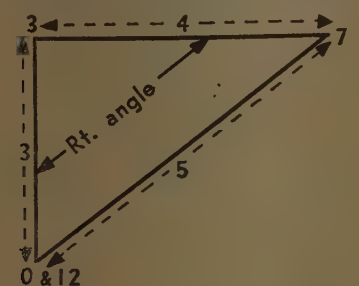
If it is necessary to mark a right angle (and it is sometimes important in ensuring that rows run at right angles transversely across the ground and to form beds which are perfectly square), a large wooden triangle can be made and bolted so that it can be dismantled when not in use. Alternatively, use can be made of the fact that a triangle having its sides equal to 3, 4, and 5 units of length respectively contains a right angle between the 3- and 4-unit sides. A length of string or cord which will not stretch marked or knotted at 0, 3, 7, and 12 feet or yards can be used.

The 3 mark is pegged at the corner to be measured and the cord to the 7 mark along the baseline. The 0 and 12 marks are then taken in hand and pulled tight. Where they meet a peg is driven in. The 3 pegs then set out a right angle. (See diagram below.)

Seed Sowing

The depth of seed sowing usually shown on the seed packet is given more as a guide than a rigid direction. To germinate and grow, seed requires certain soil conditions—favourable temperature and the correct amounts of moisture and air content.

The soil must not be so loose that the young root or radicle finds itself in an air pocket on emergence, nor so compacted (nor the seed planted so deeply) that the young growing shoot cannot force its way to the surface of the ground. If seed is planted too shallow, the soil may dry out and the tender growth suffer injury or die off.



One method of marking a right angle, using a length of string marked at 3, 7, and 12 units of length.

Small seed requires only a shallow drill, and as long as a continued supply of moisture is ensured the covering need be only enough to hide the seed from view. Seed like beet and parsnip can be covered by about ½ in. of soil, peas by about 2 in., and large seed like beans by 2 in. to 3 in. It is usually a good plan except where ground conditions are cold to make the drill a little deeper than required and not fill it completely. This serves to mark the seed drills and for such crops as peas and beans is more convenient for later earthing up.

Seed marketed by reputable seedsmen almost invariably has a high germinating capacity and should be sown thinly. Small seeds should be sown on a still day. Usually the seed can be gently shaken into the drill from the seed packet. If this is difficult, seed can be emptied into a piece of stiff paper with a V-shaped fold which can be used as a scoop. The mixing of a little sand with certain types of fine seed is sometimes helpful, but too much sand should not be used because of its tendency to sink to the bottom of the mixture.

Sowing and Planting in July

Temperature is one of the most important factors influencing growth, and though during sunny days in July air temperatures may be relatively high, in most districts soil temperatures are lowest during June, July, and August. Good growth may be made during periods of bright sunshine, but at other times the roots of any but the hardiest plants are unlikely to develop much. During this period roots are liable to damage from soil-borne organisms.

In most districts sowing should be kept to a minimum and planting limited to the setting out of hardy, well grown plants in situations where soil and climate are suitable. Small sowings of such comparatively hardy plants as broad beans, silver beet or perpetual spinach beet, peas, spinach, turnips, and even carrots and radish may be made. Lettuce, summer cabbage, and cauliflower can also be sown, though in colder districts a frame or specially favourable situation is advisable. If cloches are used, all the seed mentioned can be sown in well drained soil, but cloches should be in position about a week before sowing.

Hardy plants such as horse radish, spring cabbage, garlic, and shallots, and in North Island districts onion seedlings, can be set out if the soil is in good working condition. Where the weather is not too severe lettuce and cauliflower can also be set out, preferably late in the month in most districts.

Rhubarb and asparagus beds should be cultivated and manured. Where drainage is good and conditions are warm enough to enable the plants to respond, liquid manure can be applied to soil needing fertiliser.

If soil conditions permit, the ground can be prepared for new beds of rhubarb or asparagus. Deep digging is desirable on most heavy or fine-grained soil, as it improves drainage and aeration, which is especially important in the production of early vegetables.

Tubers of Jerusalem artichokes can be sorted over and the small tubers planted in districts where the soil is in suitable order. Potatoes in store can be sorted over and rotted ones removed. Seed tubers can be treated with DDT if the potato moth is likely to be troublesome, but such treatment should not be applied to table potatoes. In early districts some tubers can be set to sprout for planting for a first crop.

Repairs and Maintenance

When the soil is too wet to be worked the home gardener should turn his attention to jobs for which there is not always time in the busier gardening seasons. Soil and used seed boxes can be sterilised with a 2 per cent formalin solution, tools can be sharpened and cleaned, and bins, shelves, garden seats, trellises, and benches can be built or repaired. Where necessary cloches can be cleaned, repaired, and assembled for use. Paths and drains can be installed or improved.

Plans can be made for the forthcoming season's crops, special consideration being given to ensuring that each crop is succeeded by one of another family. Plans should ensure, too, that as far as possible gluts are avoided and plants appropriate to the capacity of the garden are available throughout the year. Only the varieties most suited to the district, soil, and climate should be used.

Asparagus

New beds of asparagus are usually planted in August or in some southern districts September, but where the ground is reasonably dry asparagus may be planted in July. Single rows should be about 48 in. apart and the plants set about 18 in. to 24 in. apart in the rows.

The site should first be dug deeply and if necessary drainage improved by the addition of open material, such as shingle or stones buried deeply in trenches, or by the installation of field pipes leading down to a lower level where excess water can drain away. All perennial weeds and grasses should be removed and material such as well rotted stable or farmyard vegetation dug into the bottom spit.

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Broad Beans

It is not too late to sow broad beans. If a first sowing was made in autumn, a sowing made now will provide a succession for families who are fond of these beans. They do not need special soil, but it is not advisable to sow them in light soils which tend to dry out. They do well in fairly heavy, well drained soil that has been well cultivated and into which has been dug a moderate amount of organic matter such as compost or well rotted farmyard manure.

Heavy soil should be dug deeply, preferably some time before sowing. Though a small amount of potash is often beneficial, particularly on light soils or where disease is troublesome, the principal nutrient required on most New Zealand soils is phosphate. A dressing of 2 oz. to 4 oz. of superphosphate per square yard usually gives good results. In addition a small amount of nitrogenous fertiliser such as sulphate of ammonia or dried blood may be advisable on old, well worked home garden soils that are lacking in organic matter and low in fertility.

Seed should be sown in double rows about 10 in. apart with the seed placed diagonally 4 in. to 6 in. apart and 2 in. deep in the bottom of a shallow trench or drill 3 in. deep. Germination is usually good.

The main types are represented by varieties such as Broad Windsor and Mammoth Long Pod, but dwarf types having smaller beans (for example, The Sutton) are also available and are useful in exposed situations.

Brussels Sprouts

Tall varieties of brussels sprouts usually require support if they are growing in exposed positions. Well grown plants carrying a heavy crop are worth staking individually, but for most crops at this period earth banked against the stems usually gives satisfactory support.

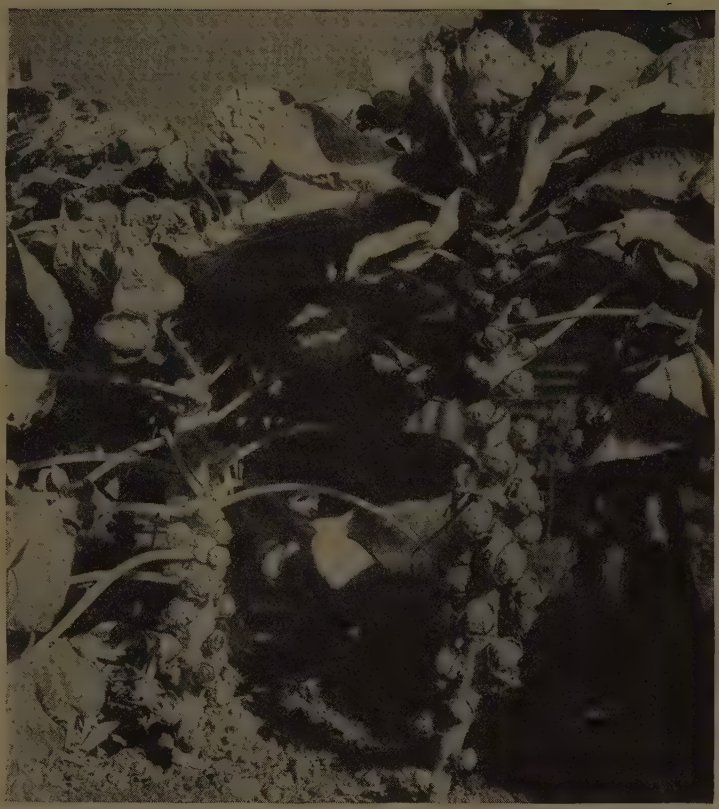
Sprouts should be picked systematically from the bottom, and to permit a good circulation of air about the plants leaves should be removed as they begin to turn yellow; at that stage they snap off cleanly at the junction with the main stem. Healthy green leaves are usually best left. If grey aphids are troublesome, plants can be sprayed with lindane or, on a still, warm day, nicotine sulphate (1 fl. oz. plus about ½ oz. of soap to 4 gallons of water).

Cabbages

Most home gardeners buy their cabbage plants at planting time, but those who prefer to grow their own seedlings can now sow a quick-maturing variety such as Golden Acre. A warm, sheltered situation with favourable soil conditions is necessary. Where these conditions are lacking it is advisable to use cloches or a cold frame or well ventilated glasshouse.

If a suitable bed is not available, seed can be sown in boxes filled to a depth of 4 in. to 5 in. with light, open-textured soil, so that when the plants are sufficiently developed they can be removed from under the glass and hardened off. This method is not, however, conducive to the production of good plants unless the plants are pricked off very early.

Conditions should encourage rapid germination and growth. The plants should be thinned whether under glass or outdoors if crowded, as the desired type of seedling for transplanting is one with well developed roots and strong, rather stocky stem and leaf growth.



[*Green and Hahn*

Brussels sprouts are among the most useful and nutritive of vegetables. To permit a good circulation of air about the plants the lower leaves should be removed as they begin to turn yellow.

Spring Cabbage

In poorer soils established crops of spring cabbages should be encouraged to make strong, quick growth by regular applications of liquid manure. If organic liquid manure is not available, sulphate of ammonia or nitrate of soda at 2 oz. to 4 gallons of water can be applied.

Spring or pointed-type cabbage can still be set out in July, and this practice is favoured by some growers in districts where the winters are severe and the land tends to lie cold and wet. If well grown seedlings are planted out in richly manured, well drained soil, the plants mature very quickly.

Cauliflowers

Most of the recommendations for growing cabbages apply also to cauliflowers, though the latter are more tender. Plants are likely to fail if they receive a check from dryness, severe frost, cold wind, or injury during transplanting.

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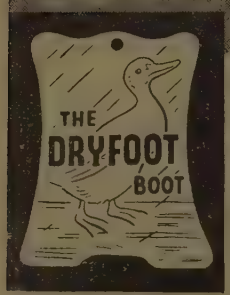

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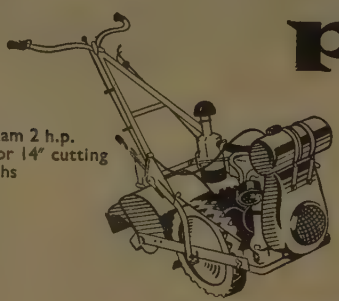
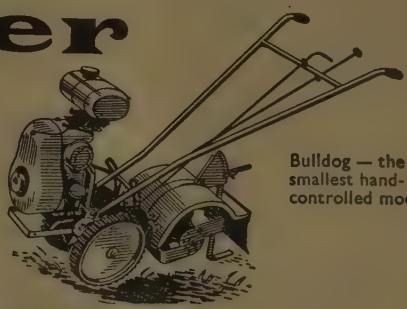


Bantam 2 h.p.
10″ or 14″ cutting widths



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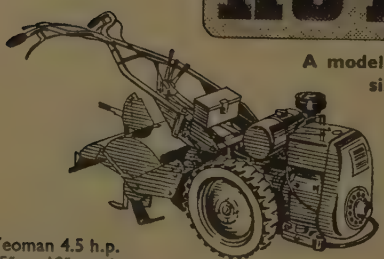
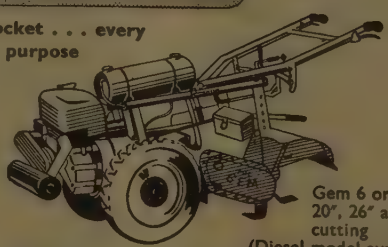


Yeoman 4.5 h.p.
15″ or 18″ cutting width



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Most of the orchards in Auckland are planted on rolling country; well tended orchards near Henderson are shown.

Development of Fruitgrowing in the Auckland District

SINCE the early days of settlement it has been amply demonstrated that many kinds of fruit can be grown successfully in the Auckland district. The mild climate with its well distributed rainfall has favoured a wide range of fruit crops which includes grapes and citrus and sub-tropical fruits as well as the more common pip and stone fruits. The development of fruitgrowing in Auckland is reviewed in this article by F. L. Bailey, Horticultural Instructor, Department of Agriculture, Auckland. The present areas and production of the main kinds of fruit now grown and marketing systems are also discussed.

LAND used for commercial fruitgrowing in the Auckland district at present is confined mainly to Waitemata County, which lies to the west and north of Auckland City. This county, which accounts for nearly 78 per cent of Auckland's orchards, includes the fruitgrowing districts of Oratia, Henderson, Huapai, and most of the orchards situated on the North Shore.

About 20 per cent of the remaining orchards are in Manukau County and in Avondale, which is now part of the city of Auckland. In the main, holdings in these last two areas are relatively small and produce mainly citrus fruits.

Some fruit is grown in Rodney County in North Auckland. Though this area played an important part in the early history of fruitgrowing, it now contains only a little more than 2 per cent of the total orchards in the Auckland district. Its importance as a fruitgrowing centre today is not nearly as great as it was in the early part of this century, when large quantities of fruit were grown and shipped out to markets.

Climate

Broadly, the climate in the Auckland district may be described as subtropical. Annual rainfall in the fruitgrowing localities varies between 50 in. and 60 in. and is usually fairly evenly distributed, but dry spells occur in some summers. There are few severe frosts and spring frosts are seldom troublesome, but citrus and subtropical fruit trees are occasionally injured by winter temperatures. Considering the number of days on which rain falls, hours of sunshine are remarkably high, the average ranging from 2,000 to 2,100 hours annually.

[*Whites Aviation*

Grape growing and wine making are a commercial enterprise associated with fruitgrowing in Auckland. The illustration shows orderly rows of grapevines in an old-established vineyard.

Winds are persistent, especially in spring and autumn, but are seldom very cold. Strong, sometimes violent, storm winds blow at intervals, usually in the warmer months, from east to north. Occasionally these winds cause loss of crop or damage to fruit trees where shelter is inadequate.

The mild climate and a generous and well distributed rainfall favour production of a wide range of fruit, including grapes and citrus and subtropical fruits. However, the long growing season and lack of intensity of winter frosts prevent some crops, such as raspberries, currants, apricots, and cherries, from fruiting as they do in colder districts.

The climate favours rapid growth of trees and plants, but that is offset materially by the ravages of equally favoured diseases and pests. Because of the persistent prevailing winds and the numerous wet or showery days, spraying is often hindered and control of diseases is sometimes difficult.

For the successful culture of fruit trees, shelter trees are required to protect almost all of the planted areas.

Soils

Orchard soils in Auckland vary from particularly sticky clays to peat with many intermediate types, sometimes several in the same orchard. Comparatively small areas of lighter volcanic and alluvial soils are also used for fruitgrowing. These are usually well drained and relatively easy to work.

The subsoils in all of the main orchard areas are clay. Usually there is about 4 in. to 8 in. of topsoil, except in gullies of rolling land and on some of the more level areas, where the topsoil is nearly always deeper. The clay soils waterlog easily and provision of efficient drainage is essential.

Drainage in most orchards has been carried out mainly by the use of open drains on boundaries connected with tile or fascine drains through the orchards. More recently mole drains have proved very satisfactory, and, where topography and fall allow, the combination of mole and open drains provides a cheap and efficient method of draining the heavy clay subsoil.

Growers try to make the best use of variations in soil types by planting apples and pears on the heavier soils, with stone fruit, especially peaches, and citrus on the lighter patches. Tree tomatoes and passion fruit require particularly well drained soils and growing of these fruits has been restricted to some extent by difficulties in obtaining suitable land. Strawberries are mostly grown on heavy clay soils as an annual crop, but special provision is made for drainage by using carefully planned open drains which divide the blocks into small beds.

Early History of Fruitgrowing

From records of fruitgrowing in the Auckland district it appears that the earliest commercial planting was made near Warkworth, a town some 40 miles north of Auckland city. In 1873 Edward Morrison purchased a property at Red Bluff on the Mahurangi River a few miles below Warkworth and by 1877 he had planted 4 acres of mixed orchard. From this small beginning was to develop an orchard of about 75 acres which became well known for its production not only in Auckland but throughout the Dominion.

Before 1900 several plantings were made in the Port Albert district, and nearer to Auckland city about the same time orchards were developed mainly on the North Shore and at Henderson.

In the early days proximity to transport was very important and limited the location chosen for planting. Carriage by water was the only practical method of transport, which explains why the early orchards were developed on land which had water access.

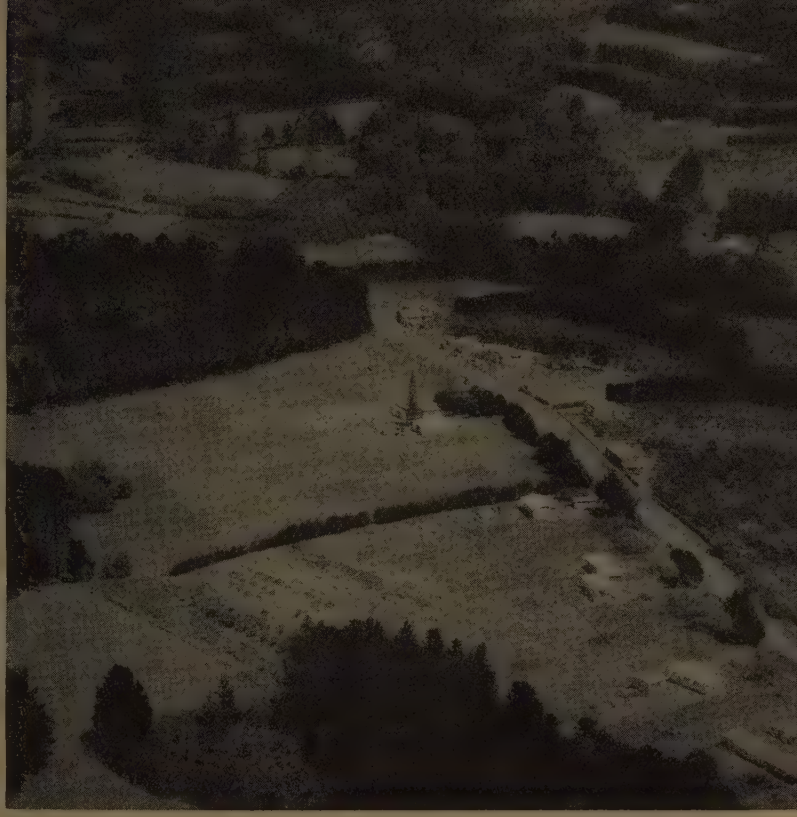
Small coastal vessls entered the fruitgrowing localities by tidal inlets to load the fruit, which was then shipped to the markets in Auckland. From Port Albert, fruit was shipped via the Kaipara Harbour and River to Helensville, and railed from this town to Auckland. Between 1900 and 1914 planting of apple trees was considerable in Port Albert and records show that production in 1915 exceeded 60,000 cases of apples, a major contribution to the overall Auckland district production at that time.

Land Development Blocks

As in other fruitgrowing areas in New Zealand, land speculation occurred. The glittering claims of the promoters attracted people of all classes to stake their future in growing fruit for local and export markets.

The first development company, known as Northern Fruitlands Limited, in 1914 took up about 5,000 acres at Huapai, which was divided into 16- to 20-acre lots and sold by the company to farmers and business and professional men. Under the agreement for sale, the company undertook to plant, cultivate, and maintain the orchards for 5 years, the buyers to meet the costs. The company also guaranteed work to any section-holder who decided to build and live on his property, but of the large number of holdings sold, only on about 20 did owners accept this offer. Altogether 113 orchards were planted, some on hillsides more suitable for sheep farming than fruitgrowing.

In many instances the soil type and situation at Huapai were unsuitable for fruitgrowing, and much of the land taken up had previously been worked over by kauri-gum diggers and was pitted with the holes dug by them. Planting in most cases was undertaken before any effective shelter was established, and most owners, being absentees, were faced with establishment and maintenance costs on orchards more or less doomed to fail before they were planted. As a result losses were incurred, many owners were unable to carry on financially, and large numbers of trees never reached production. The failure of the scheme generally is amply evidenced at present, for of the orchards developed in the Huapai area, less than 20 per cent remain.



[*Whites Aviation*

Shelter belts are essential for the successful culture of fruit trees. In Auckland pine trees are used extensively to shelter orchards.

Development at Tinopai

Following closely on the Huapai scheme, another land development company known as Komiti Fruit Lands Limited took up land in Otamatea County, North Auckland, for development on similar lines to Huapai. The area, however, was smaller and near Tinopai, a small settlement on a peninsula of the Kaipara Harbour. Access was by rail from Auckland to Helensville, thence a 4-hour trip by boat, a journey which, among other undesirable features, no doubt contributed to the ultimate failure of the scheme.

About 200 acres were planted in fruit trees, but because of exposure to winds, unsuitable sites in some instances, and general methods of culture, many of the trees like those at Huapai, did not reach the productive stage. Owners of properties found they were unable to meet their commitments, and except for a very small number of orchards the properties were either abandoned or the trees pulled out and the land converted to general farm use. By 1926 from a scheme that began 10 to 12 years earlier little remained of the originally visualised flourishing orchards. At present there are no commercial orchards in that locality.

Development after First World War

After the First World War orchard plantings were continued in the Henderson and North Shore areas, and it was at this stage in the fruitgrowing history of Auckland that the first plantings were made at Oratia.

This district was largely taken up by Yugoslavs, many of whom were associated previously with the kauri gum industry. The orchards today are still owned predominantly by families of Yugoslav descent. Plantings in the Henderson and Oratia districts during this period tended to become more mixed, whereas earlier development was mainly confined to the planting of apples. Stone fruits, particularly peaches, were set out as interplants, and citrus, usually standard lemons, were sometimes included, but the "bread and butter" on each holding was almost invariably pip fruit.

At this time plantings on a smaller scale were also made in the Avondale-New Lynn area, but in these localities a trend toward planting of citrus trees was more pronounced than elsewhere.

In the early 1930s the area devoted to fruitgrowing in Auckland reached its peak, but unfortunately it coincided with a world-wide depression. Prices were low, and in areas more remote

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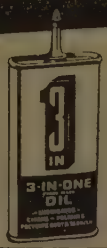

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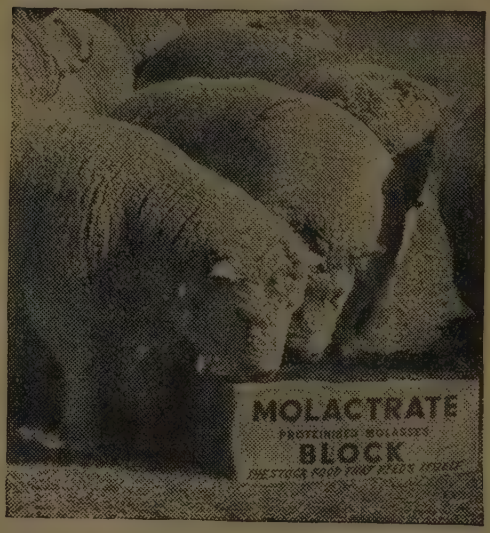

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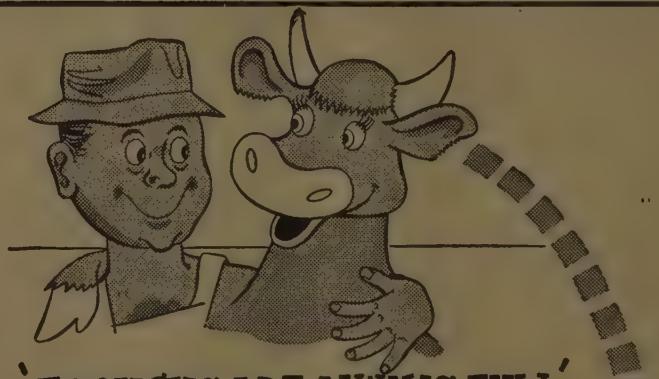

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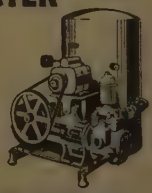

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Strawberry growing has been a commercial venture for many years. Grown as an annual in Auckland, strawberries are planted by some fruitgrowers as a cash crop in young orchards.

from marketing centres high cost of transport coupled with uneconomic prices led to neglect of orchards and eradication of trees. The area particularly affected was Port Albert, one of the oldest-established fruitgrowing districts. Trees were pulled out in large numbers and the land converted to general farm use, eventually leaving a skeleton of what was earlier an important fruitgrowing centre.

Loss of Export Market

By 1939 growers were barely recovering from the depression years when the sudden loss of the export market as a result of war created an acute local marketing problem. Costs began to increase while prices were stabilised, labour became scarce, and some growers joined the armed forces. These discouraging conditions resulted in many orchards being abandoned, while others were neglected to such an extent that they could not be renovated economically. During the war it is estimated that over 80,000 apple trees were lost to the industry in the Auckland district and most of these were either destroyed or abandoned by 1942.

Stone fruits were not much affected, but the position with standard lemons, the main kind of citrus then under cultivation, was very similar to that of apples. It is calculated that almost half of the area planted with lemons in 1939 was destroyed during the next 10 years. The only appreciable development in fruitgrowing during the war was with New Zealand grapefruit, high prices for this fruit resulting in more than 11,000 trees being planted.

Strawberry Growing

Strawberry growing has played a prominent part in the history of fruitgrowing in Auckland, strawberry culture having been a commercial venture for almost as long as tree fruits have been grown commercially. The first gardens were established mainly on the North Shore and at Avondale South, where soils were considered to be well suited for strawberries.

To the early growers of this crop must go the credit of forming the first co-operative fruitgrowers' society in the Auckland district. Old records show that because of unsatisfactory returns a public meeting was convened in 1906 by fruitgrowers in Birkenhead and Northcote to decide on some improved method of selling strawberries. At this meeting the Waitemata Fruitgrowers' Co-operative Society was formed, and the organisation was unique in that it was the first co-operative society of its kind in Auckland to sell fruit and produce.

Strawberries in Auckland are grown mainly as an annual crop and in the early years the main variety was Marguerite. However, due to the incidence of virus diseases and the disease known then as root rot, which took a severe toll, the Marguerite variety went out of favour. It was replaced with Captain Cook, a variety which today accounts for practically all of the annual plantings in the district.

As with tree fruits, strawberry growing reached its peak about 1930, when annual plantings in the district ranged from 180 to 200 acres, and for several years plantings remained static. During the war the area under production dropped to as low as 75 acres, but coinciding with improvement in the labour position and availability of nursery stock, larger plantings were made. There is, however, a considerable element of risk associated with the crop, and returns in some seasons, in comparison with those from other kinds of fruit, may be relatively poor. For this reason the tendency has been to limit plantings in more recent times to between 100 and 120 acres, a total area much less now than it was in the district 20 to 25 years ago.

Grape Growing

The only other development of commercial importance in the history of fruitgrowing in Auckland has been the cultivation of grapes. It was discovered in the early part of this century that worthwhile results could be achieved with grapes, and names which featured most prominently in pioneering efforts were the Yelas and Corban families of Henderson. The grape-growing and wine-making establishments of these families are still in existence.

Early efforts to grow grapes in the Auckland district were retarded mainly by the occurrence of phyl-

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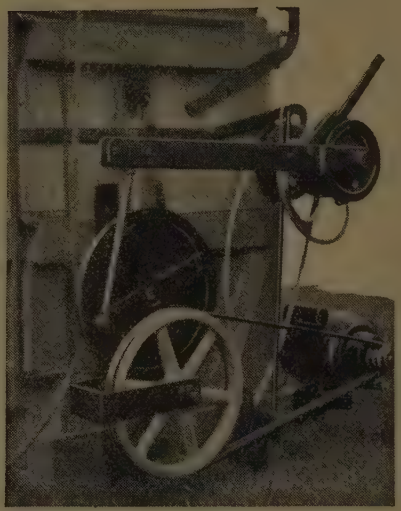

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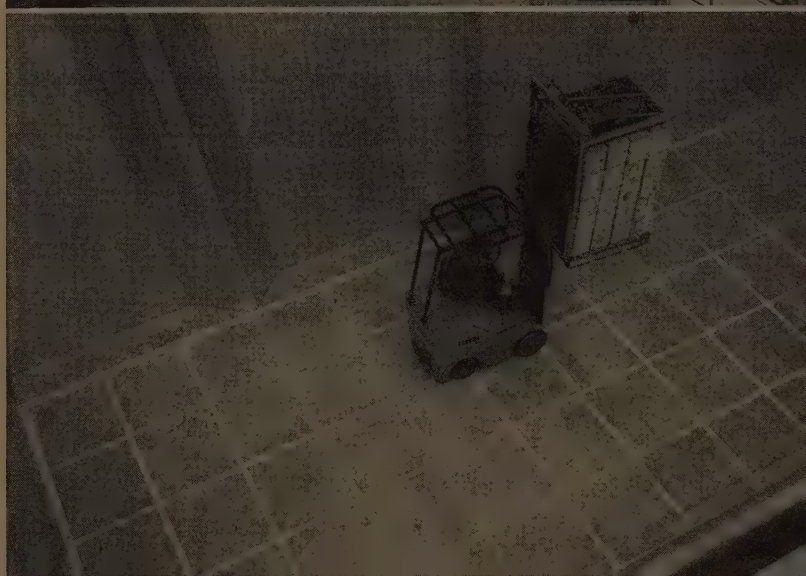
loxera, the vine louse, which lives on and destroys the roots of vines. High rainfall and the incidence of fungous diseases also contributed to the grape grower's difficulties with the European varieties that were grown exclusively in the early days. The main varieties grown were white and black Pinots, Early Malingre, Golden Chasselas, Muscat Hamburgh, Black Hamburgh, Shiraz, and Cabernet.

In later years the ravages of phylloxera were largely overcome by replacing the early varieties with the hardy and more disease resistant Franco-American hybrid varieties.

Most of the vineyards in the Auckland district have been developed in conjunction with orchard holdings. Many produce dessert grapes as well as wine, and most of these properties are worked by growers of Yugoslav descent. There has also developed a number of small holdings in which dessert grapes only are grown. The predominant variety is Albany Surprise, which originated in the Albany district, as a mutation of the Isabella variety and was selected and propagated by the late Mr G. Pannill about 1900 because of its larger berries.



UPPER—A modern fruit cool store with a capacity of 100,000 bushels. MIDDLE—Cases of fruit stacked on pallets inside the cool store. LOWER—Modern equipment is used for stacking. A fork-lift truck in action. Sparrow photos.

The culture of grapes under glass has also proved worthwhile and a number of glasshouses in Auckland are used for growing table grapes, the main varieties being Black Hamburgh and Gros Coleman. During the last war and early post-war years wine grape production greatly increased in Auckland to meet the demand for New Zealand wines, mainly created by the restrictions on the importation of wines and spirits.

Present Plantings

In 1956 the area devoted to the production of tree fruits, grapes, and strawberries in the Auckland district was estimated to be about 3,800 acres. Today most orchards comprise a mixture of fruit trees and some have grapevines, but pip and stone fruits usually predominate.

Proximity to large consumer markets has led to the development of mixed fruit tree planting, and harvesting of fruit is spread over a large part of the year. For these reasons the average size of orchards in the district is small, about 8 acres, but individual holdings vary considerably and are larger than average in the Oratia and Huapai districts.

In Table 1 the present areas of the principal kinds of fruit are estimated, and for comparative purposes estimates

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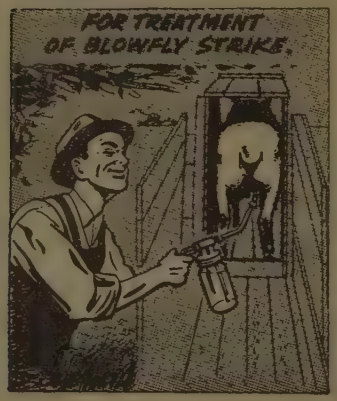

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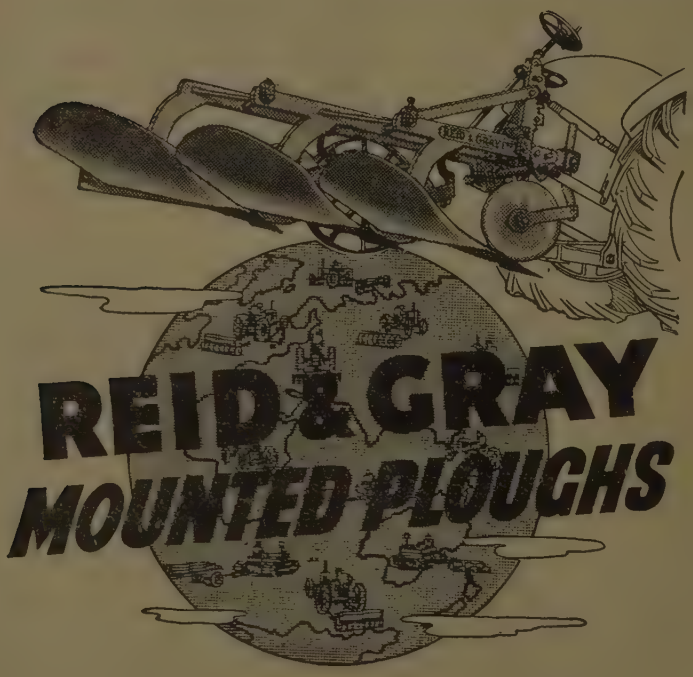

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are shown for 1939, before war affected the fruitgrowing industry in Auckland.

TABLE 1—FRUIT TREE AREAS IN AUCKLAND DISTRICT

	Estimated area 1939	Estimated area 1956
	acres	acres
Pip fruits	1,900	1,400
Stone fruits	900	1,200
Citrus fruits	500	500
Sub-tropical fruits	25	70
Grapevines	300	500
Strawberries	200	120
	3,825	3,790

Though the present total orchard area is virtually the same as it was before 1939, there have been notable changes in the areas of some of the fruits grown.

There are now 500 acres less of pip fruits, mostly apples, whereas the area of stone fruits, mainly peaches, has increased by 300 acres. The area in citrus fruits shows no change. Standard lemon trees, however, suffered heavy reductions during the war years, but plantings of N.Z. grapefruit compensated in the main for that loss.

Sub-tropical fruits, such as tree tomatoes and Chinese gooseberries, were little grown before 1939. The reduction in the quantities of imported sweet oranges and tropical fruit during the war created a demand for locally grown sub-tropical fruit and accounts for the increase in the total area now grown. Restrictions on imported wines and spirits were mainly responsible for more grapevines being planted. The increase of 200 acres consists mostly of grape varieties planted for wine production.

Production

No reliable records of fruit production in Auckland before the 1939-40 season are available. Even from that time figures for total production are necessarily estimates, because records of actual quantities produced are not available from any source. Nonetheless estimates are calculated carefully each year and may be accepted as being reasonably accurate.

In Table 2 estimated production of the main fruits grown in Auckland in the 1955-56 season is compared with estimated production for 1939-40 season.

TABLE 2—FRUIT PRODUCTION IN AUCKLAND DISTRICT

	1939-40	1955-56
	bus.	bus.
Apples	315,000	341,500
Pears	21,500	74,000
Quinces	2,300	7,000
Peaches	47,000	76,000
Nectarines	1,750	550
Plums	48,000	37,000
Lemons (standard)	27,000	14,000
Lemons (Meyer)	200	2,100
N.Z. grapefruit	30,000	62,000
Sweet oranges	1,800	3,600
	tons	tons
Sub-tropical fruits	60	190
Grapes	1,200	2,000
Strawberries	500	360

The most notable feature in fruit production since 1939 has been the increase in pip fruits despite the reduction in area of 500 acres. There is no doubt that average production per tree has increased for most kinds of fruit since pre-war days. Production may vary from year to year, and though the 1955-56 season was a good one for apple and pear production, it was average for other fruits.

If the difficulties during the war years are taken into consideration, the present standard of production reflects considerable credit on growers and manufacturers of the spray chemicals and equipment that have done much to increase and improve the quality of fruit now produced.

Urban sprawl is limiting the life of some orchards near Auckland city. Subdivision of old-established orchards for residential purposes is now a common sight, particularly in localities 10 to 12 miles from the city.

Marketing

There have been changes over the years in methods of fruit marketing in Auckland. Before 1939 locally grown fruit was either sold by auction or by private treaty and this still applies to fruit other than apples, pears, lemons, and sweet oranges.

Over the years various fruitgrowers' co-operative trading societies were formed to sell their products and though some succeeded for a time, all in the end failed financially. The City Markets, Auckland, which comprise the premises of several old-established fruit and produce brokers, are the wholesale clearing houses for fruit grown for local market. The locality of the markets has changed from time to time, but merchants dealing in the wholesale fruit trade have been consolidated in one block of centrally situated premises since about 1918.

Shortly before the war poor prices were being received for standard lemons, largely owing to importations, and at the request of lemon growers a marketing scheme was instituted by the Government in 1939 in an attempt to put lemon growing on a sounder basis. As a result all standard lemons were supplied to the Internal Marketing Division of the then Primary Products Marketing Department and the grower was given a minimum guaranteed price. The fruit was still sold through the city markets, but at a fixed price and not by auction.

In 1940 a similar scheme was introduced to cover the purchase and distribution of apples and pears, but this was brought about by an acute local marketing problem caused through the outbreak of war and loss of export markets. At present there are statutory bodies to look after the marketing interests of pip and citrus fruitgrowers.

The New Zealand Apple and Pear Marketing Board is responsible for the marketing of the apple and pear crop. The Citrus Marketing Authority has a similar responsibility with New Zealand-grown sweet oranges and lemons. In Auckland both these organisations have new, modern buildings and up-to-date equipment for handling large quantities of fruit for assembly and distribution.

The fruitgrower of the past relied on the weather, the tide, and the regularity of shipping services for transport, and the law of supply and demand governed the returns for his fruit. More recently, some sections of the industry have formed Dominion-wide marketing authorities to organise distribution of fruit to obtain more stable returns by keeping all markets regularly supplied.

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Improved Method of Fitting Wax Foundation to Sections in Comb Honey Production

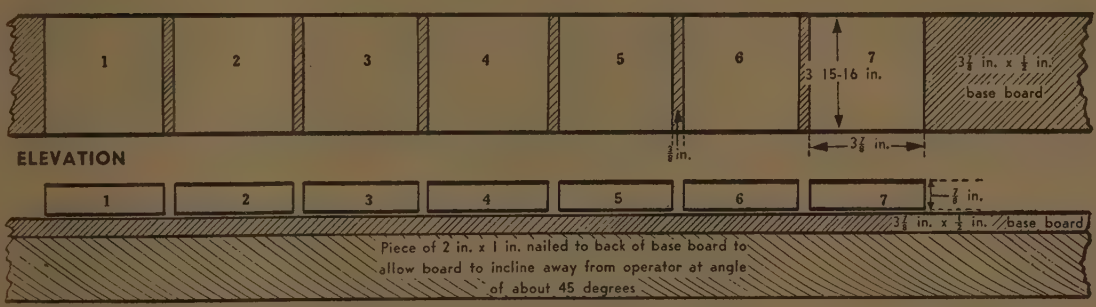
SUCCESSFUL commercial production of consistently high-grade section comb honey demands intensive supervision of colonies, very close attention to detail, and the use of only the best of equipment, correctly assembled. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Northland, describes an improved method of attaching foundation to sections. As practised by Mr B. G. Sharp of Matakana, a commercial comb-honey producer, this method has greatly improved the finish and the attachment of the comb to the woodwork of the sections and has reduced to a minimum the number of sections rejected as unsaleable through light weight and faulty finish or attachment.

FOR section comb honey to present an attractive appearance and to be able to maintain that appearance throughout the period of handling necessary in the harvesting and packing of the sections, together with the stress of transport over long distances, it is essential that combs in the sections be evenly built and firmly attached to the whole of the inner surface of the woodwork. Section comb honey is more dependent on outside appearance for customer appeal than any other form of honey. Needing extreme care in handling to prevent damage to the surface and breaking of the comb from the woodwork, it is a product which is comparatively costly in time and labour to produce and any factor which will improve the appearance and strength should be of considerable importance to commercial producers.

Over a number of years in which he has been engaged in the production on a comparatively large scale of section comb honey, Mr Sharp has found that the use of split sections, where the foundation is held in position by the split in the top of the section, has resulted in a very large proportion of the total sections produced being rejected as unsuitable for export on account of uneven construction and lack of proper attachment of the comb to the woodwork. In an endeavour to improve substantially the finish of his product he adopted the method of attaching top and bottom strips of foundation to sections recommended by many of the larger United States producers. Results have been very satisfactory. Since the adoption of this method the proportion of rejects for export has dropped from over 30 per cent to less than 12 per cent of the whole and the general appearance and evenness of construction of the combs have been much improved.

Either split or non-split sections can be used with this method of foundation attachment, but the non-split type

Section-holder Board for Improved Method of Fitting Wax Foundation to Sections



Timber needed: 1 piece 3⅞ in. x ½ in. 3 ft. long; 1 piece 2 in. x 1 in. 3 ft. long; 7 pieces 3⅞ in. x 3 15-16 in. x ⅞ in. thick (these must be of fine-grained timber dressed very smooth and preferably polished).

Section-holder board, showing back piece.

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is preferable, as it provides for easier cleaning and gives an enhanced appearance to the woodwork.

Extra Equipment Needed

Equipment needed to carry out this work satisfactorily is (1) a section-holder board for holding the sections while the strips of foundation are attached, (2) a heated tool for melting the foundation edges, (3) a cutting box to allow accurate cutting of the foundation. Construction of this equipment should be well within the capabilities of any beekeeper used to handling woodworking and soldering tools.

Section-holder Board

The section-holder board is used to hold the sections while the strips of foundation are fixed in place with the heated tool. It is simply a piece of board to which are screwed a series of wooden blocks. In use the sections are folded into shape and then placed over the wooden blocks, on which they are a loose fit. They serve to position the foundation while it is fixed in place.

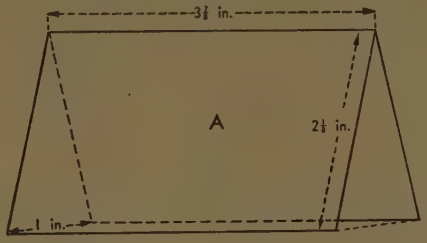
The layout of the section-holder board can be arranged to suit individual requirements, but it is essential that the blocks are cut correctly to size and are accurately positioned and spaced on the holder board. A block size suitable to the 4¼ in. x 4¼ in. standard-size section is 3⅞ in. long x 3 15/16 in. deep by ⅞ in. thick. The blocks should be very slightly chamfered on the edges of the working surfaces, which should be dressed to a very smooth finish and preferably polished. Blocks must be spaced ⅜ in. apart on the holder board, irrespective of whether they are placed in one row of seven (as shown in the upper illustration on page 593) or in double rows or more. A support is fixed to the back of the holder board so that in use the blocks incline away from the operator at an angle of 45 degrees.

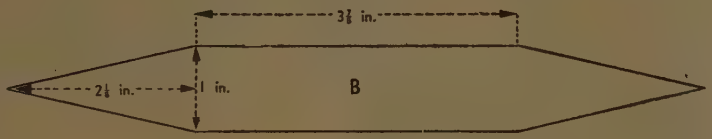
Steam-heated tool with boiler.

FITTING WAX FOUNDATION TO SECTIONS

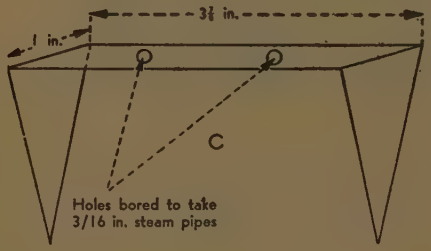
Steam-heated Wax-fixing Tool

A—Piece of 22- or 24-gauge sheet copper 4¼ in. x 3⅞ in. folded to form sides and working edge of steam chest.



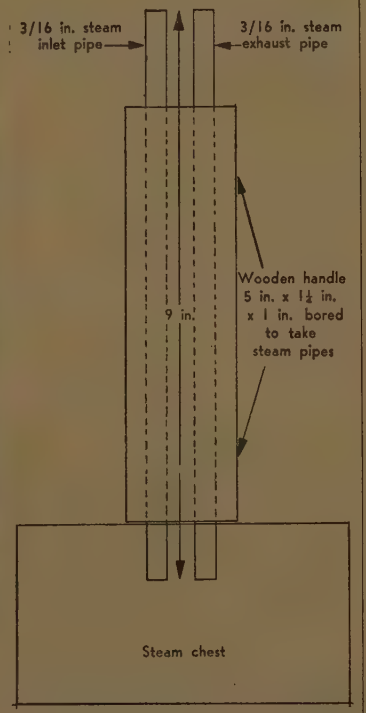


B—Piece of 22- or 24-gauge sheet copper to form top and ends of steam chest. C—Piece of copper B folded to form top and ends of steam chest.



[*Sparrow*

Above and at right—The completed tool.



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Half-hearted, sceptical attitudes towards making offal safe for feeding to work-dogs is keeping hydatids active.

The key to hydatids control is to boil all offal you feed dogs. Pluck cut up and boiled for 30 minutes, is safe food.

You can dose and clear your dog of worms but it will quickly be re-*infested* unless its food is cleared of infection by *boiling*.

Never throw raw lungs, livers, hearts or spleen to your dogs. They become infected by eating hydatid cysts in those organs.

Burn or bury carcasses lying on your property, or at least remove and heat-treat or bury the pluck.

The best attack in hydatids is the breaking of the disease cycle by feeding only sound material to dogs. Reinforce this attack by dosing your dogs regularly with arecoline.

PROTECT YOUR CHILDREN from hydatids

- Insist on strict hand-washing after handling dogs and always before eating.
- Wash vegetables and fruit you eat raw.

10.7a

Condemned children, condemned livers, this is the price of apathetic hydatids control.

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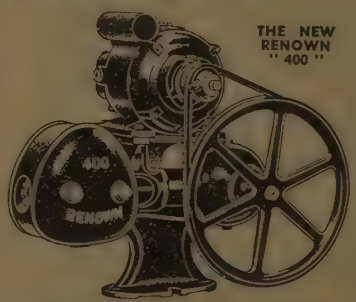

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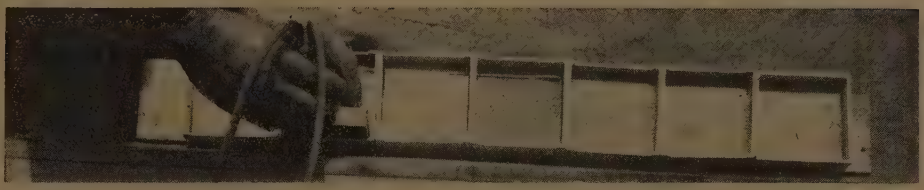
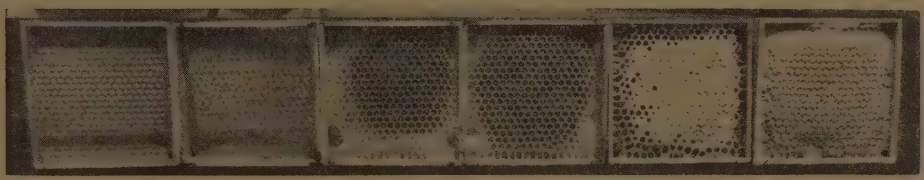
IMPROVED METHOD OF FITTING WAX FOUNDATION TO SECTIONS

Attaching top piece of foundation. This is done after the bottom strip has been attached and the holder board turned round.



This shows how sections are drawn by the bees from both top and bottom.



Wax-melting Tool

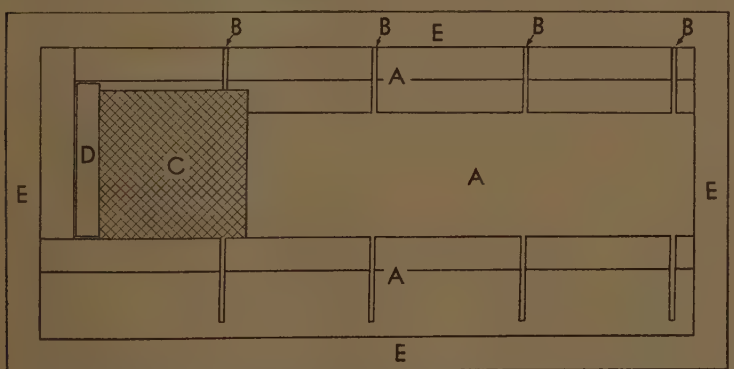
Because with this method the foundation is attached to the section by heating and melting one edge of the foundation, it is necessary to have some means of keeping the tool used for the work continually heated. For this purpose Mr Sharp has devised a steam-heated tool which is supplied with steam from an electrically heated boiler of the type normally used to supply a steam-heated uncapping knife.

Because the tool receives a constant supply of steam, it does not cool off in use and consequently there is no delay in the assembling of sections through waiting for the tool to be reheated. The diagrams on page 595 show the construction of the tool. When constructing the tool it is important to see that the lower edge of the V-shaped container, which is the working edge, is smooth and straight. Material needed is one piece of 22- or 24-gauge copper sheet 4¼ in. x 3⅞ in., one strip of similar gauge copper sheet 8⅛ in. long and 1 in. wide, 14 in. of 3/16 in. internal diameter copper tube, and one piece of wood 5 in. long to be bored out to make a handle.

To make the tool the longer piece of copper is folded across the middle of the length to form a narrow-angle V 1 in. wide at the top. The narrow strip is then cut to a taper at each end and folded to make the top and ends of a V-shaped container. This is neatly soldered in place and two holes are drilled in the top to take two pieces of 3/16 in. pipe, which will form the steam inlet and exhaust pipes. These are securely soldered in place, each being allowed to project a short distance into the container. The wooden handle is then bored out and attached.

Foundation Cutting Box

To cut foundation quickly and accurately into the two sizes needed it is necessary to use a foundation cutting box. This is an open oblong box similar to a mitre box 2 in. to 2½ in. deep, 4 in. wide, and 16½ in. long. Four saw cuts are made in the sides so that when sheets of foundation are placed in the box they can be cut into pieces 3⅞ in. long.



Foundation cutting box. A—Walls and floor of box. B—Saw cuts. C—Stack of cut foundation in position for cutting narrow, bottom strips. D—Spacer block in position, causing foundation to extend correct distance beyond saw cut. E—Base board for screwing box to work bench.

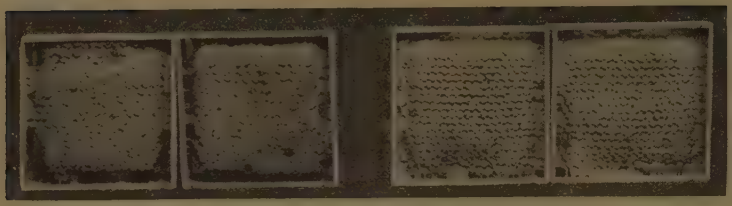
Because with this method two pieces of foundation are used in each section, the foundation must be cut a second time. In each section a piece of foundation 3⅞ in. long and 3¼ in. wide is attached to the top of the section and a second piece 3⅞ in. long and ¾ in. wide to the bottom. To obtain these second, smaller pieces the pieces first cut are lifted from the cutting box and a wooden block ¾ in. thick is inserted against the closed end of the box. The foundation is then replaced in the box, the wooden block causing it to project the exact width of the bottom strip beyond each saw cut. As the foundation is replaced in the box preparatory to the second cut it is turned at right angles to its former position so that the ¾ in. bottom strips when placed in the section will have the cell bases running horizontally as in the upper piece.

To cut foundation cleanly a sharp knife is necessary. It should not be used with a sawing motion, but with an action similar to that of a guillotine. Foundation should not be too cold or too warm when being cut. A temperature of 65 to 70 degrees F. is most suitable. If too cold, the foundation will shatter when cut; if too warm, the pieces will adhere to one another and become damaged when separated.

Fitting the Foundation

With the section-holding board in front of him the operator places the folded sections on the block with the tops uppermost. The ¾ in. strips of foundation are then placed in position at the bottom of the section and held in place with the tips of the thumb and forefinger of the left hand. The heated wax-melting tool is held in the right hand and the working edge placed against the lower edge of the foundation. At the same time the tool is given a slight motion sideways to spread the molten wax evenly over the woodwork where the foundation

FITTING WAX FOUNDATION TO SECTIONS



Comparison of sections from one colony. Those at left are from sections with one piece of foundation fixed in the split; those on the right are from the double-strip method.

is to be attached. As soon as the wax has melted the tool is removed and the strip of foundation quickly pressed into position with the tip of the thumb and forefinger. When all the bottom strips have been attached the holder board is turned upside down and the longer (3¾ in. by 3⅛ in.) pieces are attached to the top of the section in the same manner.

Advantages

Though this method of fixing foundation to sections may at first seem to be much slower than that where the foundation is held by the split top of the section, practice soon enables an operator to reach a speed only slightly less. Advantages gained by the use of this method have been found to more than compensate for any loss of speed in assembly. The main advantages to be gained from this method are:

1. Much more secure attachment of the comb to the woodwork. This is important, particularly where sections are transported long distances and then shipped overseas.
2. Improved appearance.
3. More even weights.
4. Fewer sections graded seconds on account of light weight or insufficient attachment of the combs.
5. Less breaking away of foundation from the section in transit to outapiaries and when being drawn out by the bees.
6. Easier cleaning of section woodwork, particularly when non-split sections are used.
7. Much better construction of section combs by the bees in periods of light or broken honey flows.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during March 1958 and for the 8 months ended 31 March 1958 with comparative figures for the same month and the 8 months of 1956-57 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc. or dec.
March 1958	14,098	263	14,361	—
March 1957	9,132	254	9,386	—
Increase	+4,966	+9	+4,975	53.004
8 months ended 31/3/58	156,034	2,514	158,548	—
8 months ended 31/3/57	139,147	2,515	141,662	—
Increase	+16,887	—1	+16,886	+11.920

Butter in store at 31 March 1958 was 31,645 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
March 1958	6,645	1,268	7,913	—
March 1957	7,141	858	7,999	—
Decrease	—496	+410	—86	—1.075
8 months ended 31/3/58	66,331	11,565	77,896	—
8 months ended 31/3/57	68,177	9,256	77,433	—
Increase	—1,846	+2,309	+463	+0.598

Cheese in store at 31 March 1958 was 24,984 tons

If these figures are converted into butterfat equivalent, there is an increase of 9.682 per cent in butterfat graded for the 8 months as compared with the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place they are not necessarily a true indication of production trends.

Superintendent, Beekeeping Industry, Retires

MORE than 40 years of continuous service to the beekeeping industry have been given by Mr T. S. Winter, Superintendent, Beekeeping Industry, Department of Agriculture, who retires this month.

Besides the 34 years Mr Winter spent with the Department he gained valuable experience in his earlier years by employment in commercial beekeeping in Canterbury, with the New Zealand Honey Producers' Association, Auckland, and as secretary of the National Beekeepers' Association of New Zealand.

Born at Hamilton, Mr Winter first became interested in bees when a schoolboy. He worked as a cadet in the apiary sections at the Ruakura and Tauranga Government experiment stations.

Mr T. S. Winter.

In the First World War Mr Winter served in Egypt and Gallipoli. In 1918 he was appointed Apiary Instructor at Christchurch and was subsequently Apiary Instructor, Hamilton, Chief Honey Grader, Auckland, Senior Apiary Instructor and Honey Grader, Wellington, and in 1949 he became Superintendent, Beekeeping Industry.

Mr Winter has contributed notably to the administration and practice of the beekeeping industry. He played a large part in the design and introduction of the present official honey export grading system and standards for payout to producers. He has also written extensively on commercial and domestic apiary work, about 10,000 of his comprehensive bulletin "Beekeeping in New Zealand" having been distributed to date.

During Mr Winter's superintendency much new beekeeping legislation was introduced, which involved increased responsibility in administration. Among the regulations were those affecting honey export and apiary registration and protection.

A Quilted Satin Set is Useful Gift

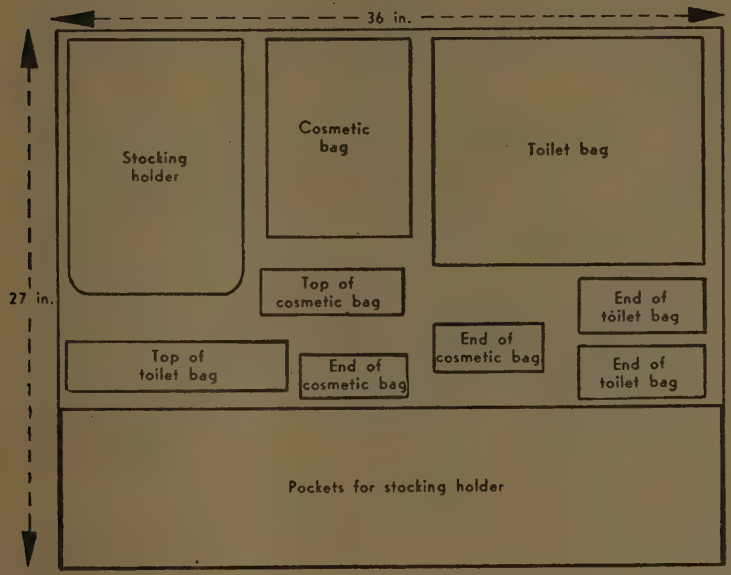
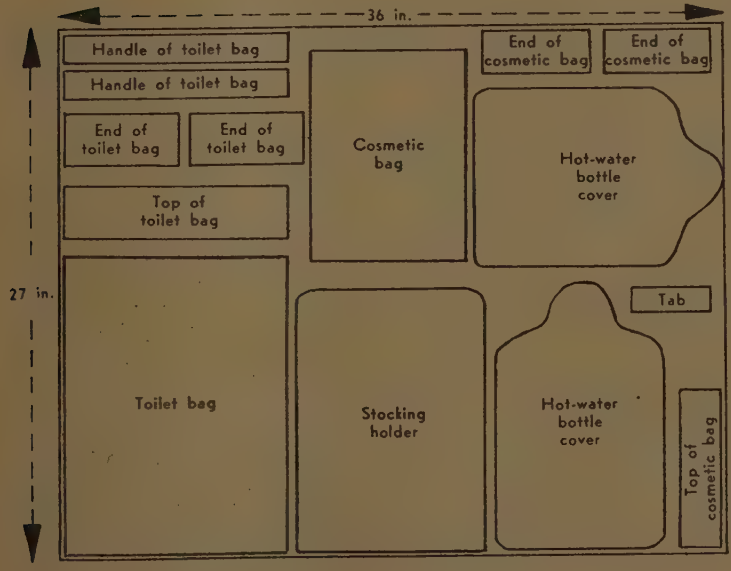


Fig. 1—The layout for the plastic. Before cutting, it may be advisable to make paper patterns of the various pieces from the given measurements. By placing these on the plastic and quilted fabric as shown in the diagrams there will be less danger of incorrect cutting.

Fig. 2—The layout for the quilted satin.



By PATRICIA M. BAWDEN,
formerly Home Science Instructor,
Department of Agriculture,
Palmerston North

THE quilted satin set illustrated on page 600 would be a very acceptable gift at any time. Such a set may be very inexpensively made and with very little effort. The quilting may be made by placing satin over a layer of cotton wool backed by fine muslin and diagonally stitching these into a diamond pattern. However, to save much time and labour it is far easier to use already-quilted material. This is available in 36 in. widths, and ¾ yd. is enough to make the set illustrated. The finished cost will be a little over £1 for the four pieces.

FOR the set illustrated pale-blue satin was used, but the quilted satin fabric is available in white and various pastel shades.

The materials required are:

¾ yd. of 36 in. pale-blue quilted satin
¾ yd. of 36 in. white non-transparent plastic
¼ yd. of pale-blue taffeta
6 in. and 11 in. slide fasteners
1 yd. of pale-blue bias binding
1 yd. of narrow blue ribbon
1 reel of pale-blue mercerised cotton
1 button (to fasten the stocking holder)

Measurements for Cutting

Before cutting, it may be advisable to make paper patterns of the various pieces from the given measurements. If these are placed on the quilted fabric as shown in Figs. 1 and 2, there will be less danger of incorrect cutting.

The measurements for the four articles are:

The toilet bag—

*Oblong 15 in. x 12 in.
*End strips (cut 2) 6 in. x 2½ in.
*Top strip 12 in. x 2½ in.
Handles (cut 2) 12 in. x 1½ in.

The cosmetic bag—

*Oblong 11 in. x 8 in.
*End strips (cut 2) 5 in. x 2½ in.
*Top strip 8 in. x 2½ in.
Tab handle 4 in. x 1½ in.

The stocking holder—

Cut a piece 13 in. x 10 in. (rounded at one end).

From the plastic only, cut a strip 36 in. x 8 in.

The hot-water bottle cover—

2 pieces of 14 in. x 9½ in. Shape at the top to cover the bottle. Trace round hot-water bottle to check size.

* Pieces to be cut from both the quilted satin and the plastic material.

The pale-blue taffeta for the lining for the cover of the hot-water bottle is cut to the same size as the quilted satin.

To Make up

The Toilet Bag

Take the oblong piece of quilted satin and find the centre point along the 15 in. edge. Set the centre of the 2½ in. side of one end section against this, pin together, then machine across the bottom and along one side. From the bottom again machine the third side. Repeat this at the other end so that there is an open "box".

Do the same with the corresponding pieces of plastic.

Now take the quilted satin strip for the top of the toilet bag and the 11 in. slide fastener. Mark the length of the fastener on the strip and cut along the centre of it to within ¼ in. of the end of the slide fastener at either end. Snip out about ¼ in. as shown in Fig. 3.

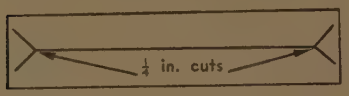


Fig. 3—The slit for the slide fastener.

It is advisable at this stage to press these edges back firmly with a hot iron before attempting to set the slide fastener in place, as the padded material may be rather bulky to handle. Tack and machine the fastener under the opening, keeping the stitching close to the turned-under edge to prevent fraying out of the satin and the padding.

Cut a slit along the top strip of the plastic lining to correspond with that cut for the fastener in the quilted fabric. Machine this piece of plastic into place to complete the lining.

To make the handles fold the strips in half, tuck in the edges, and machine together. Again it may be advisable to press the edges firmly before machining to prevent fraying.

Now set the top section into the quilted satin "box". The handles should be placed about 2 in. in from either end. With the bag inside out machine across one end, along the side, and across the second end. Remove from the machine, turn the toilet bag right side out, and then sew along the last side, working through the opening.

Before fitting the plastic lining in place cut a cardboard strip 12 in. x 2½ in. or to the same size as the bottom of the toilet bag. This should be stiff and should fit firmly to square the base and give a flat surface for the bag to stand on.

Fit the plastic lining into the quilted satin bag, turn under the edges of the top slit, and hand sew to the back of the slide fastener.

Check that all corners are well pushed out and squared.

The Cosmetic Bag

The cosmetic bag is made by the same method as the toilet bag except that the tab handle is fitted in at one end of the bag instead of at the side. The cardboard base will measure 8 in. x 2½in. and again should be made to fit firmly.

The Stocking Holder

Directions for the making of a holder similar to that described here appeared in the September 1957 issue of the "Journal of Agriculture". However, as it forms part of the set, instructions are given briefly here.

Take the strip of white plastic measuring 36 in. x 8 in. and bind along each side with pale-blue bias binding.

Machine across to form a circle.

Fold as shown in Fig. 4 with the join underneath. Then bring points

Fig. 4—The stocking holder. To form the pockets the plastic strip is joined by bringing the points B into the centre (A) and stitching them together.

marked B in to the join and stitch together where they meet.

Now machine across 4 in. in from the bias binding. Then machine to the plastic lining of the holder, allowing ½ in. clearance at the straight edge (see Fig. 5).

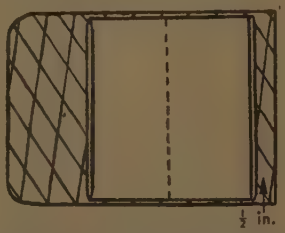


Fig. 5—The stocking holder. Machine the pockets to the plastic lining, allowing ½ in. at the straight end.

Now with right sides together machine the lining (with the pockets attached) to the quilted satin covering; leave sufficient space to turn right side out.

Turn to the right side and machine round again close to the edge.

Fold over and attach a button and fastening to the envelope flap.

The Hot-water Bottle Cover

Begin by machining together the two pieces of quilted satin (along the sides and across the lower edge), leaving a space of 2 in. in the centre of the bottom for the tab on the hot-water bottle (see Fig. 6).

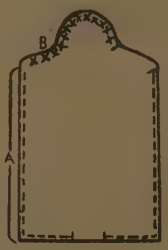


Fig. 6—Stitching of the hot-water bottle cover. A—Stitching of sides and lower edge. B—Stitching of lining to quilted satin.

Sew the two pieces of taffeta lining together in the same manner.

Now place the right side of the quilted satin and the taffeta together. Machine around the top, leaving sufficient gap to turn the cover right side out.

Turn through to the right side. Hand sew around the bottom opening, then around the gap left at the top.

Attach ribbons at either side to fasten the bag at the top.

Press around the edge.

This completes the set. If the set is to be a gift, the various containers should be padded out with crumpled white tissue paper, or if desired the various objects for which they have been made could be placed in them.

USE OF ACCESSORIES IN HOME DECORATION

By ELEANOR COUSTON,
Home Science Instructor, Department of Agriculture, Christchurch

THE final touch to any decorative scheme is added by the use of accessories. The skilful use of pictures, mirrors, flower arrangements, lamps, cushions, and ornaments will bring a neutral room to life, create an atmosphere of homeliness, and express the originality and taste of the owner. Some accessories have a purpose and others are purely decorative, but in either case they should harmonise with the other furnishings and enhance the appearance of the room.

A FINE sense of beauty is shown in the Japanese type of decoration where one beautiful tapestry panel or a perfect arrangement of flowers provides the only interest. Plain walls form a background for this one focal point and its beauty is given emphasis because there is nothing to detract. Though this idea is not entirely applicable to western standards, the main element, simplicity, could be used as a guiding principle.

Heading photograph by Green and Hahn.

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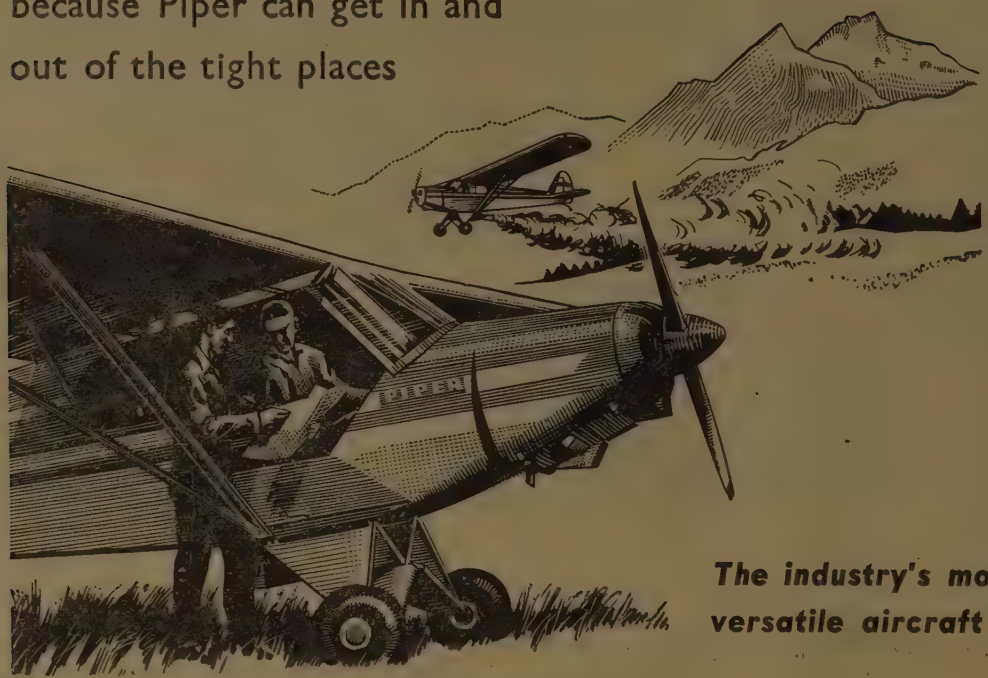

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In contrast to this is the type of decoration associated with the Victorian period, where numerous bric-a-brac, ornaments, over-decorated cushions, and rose-painted lampshades create an impression of disorder and clutter.

The contemporary trend indicates a more judicious use of accessories, fewer in number, but each object a point of interest in itself and in accord with the colours and the style of the room.

Sentiment plays quite an important part in the value placed on decorative pieces. Regard must be shown for gifts and heirlooms whether they conform to one's own taste or not. The natural tendency is to try to find a place for them all, with the result that the mantelpiece, the windowsill, the occasional tables, and the piano become littered with a haphazard collection. Each object loses importance, dusting is a nightmare, and the decorative scheme is ruined. When this occurs a better plan is to display a few at a time and create new interest by replacing these at intervals with others.

When the choice of accessories rests with oneself there are fewer limitations. It is not always the cost which determines whether the article will be right or wrong, but rather the difference between a good choice or a bad. Will it fulfil its purpose and is it beautiful, in good taste and of good design? These qualities are difficult to define, but the essentials are simple, clean lines, lack of camouflage, and beauty of materials and workmanship. An article which appeals because it is "cute" will quickly pall, but one of good design will give continual satisfaction.

Consideration should also be given to the placing of each article so that it will be in scale and colour harmony with its surroundings.

There is endless scope for originality in both the choice and arrangement of accessories and they can be the certain "something" which gives a room character and individuality.

Proportion and Balance

For satisfying results the basic principle of proportion and balance should be applied to accessories as well as to furniture. In a large room, on a large expanse of wall, or on a large mantelpiece small accessories are insignificant, but where they are in proportion the effect is pleasing. So each piece should be studied to make certain it is in scale with its surroundings.

Balance is the pleasant effect which results when shapes and colours are placed around a centre to give equal attraction on either side. Formal

Too many accessories together with an ornate fireplace create an atmosphere of clutter.

[*Green and Hahn*

This remodelled fireplace with its simple lines displays to advantage a few beautiful pieces.

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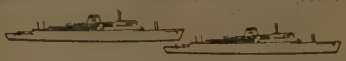

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A decorative grouping which is well balanced and appropriate to its setting.

[*Green and Hahn*

▼ One small picture loses effect above a large chesterfield. A group of three pictures of the same size as that shown would be in better proportion.

balance is achieved when furniture or accessories which are similar in size and shape are placed at equal distances from a central point. This gives a sense of precision and if used exclusively, may be rather stiff and uninviting.

Informal balance is less precise and is obtained in the same way as on a see-saw by the placing of different weights or attractions at different distances from a central point.

The two types can be combined successfully with perhaps a formal arrangement of accessories on the mantelpiece, while the furniture is balanced informally by arranging a chesterfield on one side of the fireplace and two chairs on the other.

Pictures and Mirrors

Pictures are frequently one of the most important accessories and are sometimes used as the basis for the colour scheme of a room. Their choice depends on personal taste, but the subject and colouring should harmonise with the rest of the furnishings.

Their frames should be appropriate so that they complement rather than dominate the pictures themselves. Narrow, simple frames are suitable for line drawings or etchings, and heavier frames can be used with paintings which are bold in colour. Many pictures are now framed without a mount, but some of the smaller prints

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are made more effective by use of coloured mounts which repeat an accent colour in the furnishings.

A particularly beautiful picture may warrant a special light to show it to best advantage.

The way in which pictures are hung makes a considerable difference to their effectiveness. The rule of proportion is of primary importance; a small picture hung above a large piece of furniture looks inadequate.

If small pictures present a problem, several which are similar in character may be grouped together. Either their upper or lower frames should be level for the most satisfactory results. "Stepping" pictures is a method of hanging which should be reserved for stairways.

Grouping can also be applied successfully to family or personal photographs. When these are scattered at random round a room they add nothing to the decorative scheme, but if framed and grouped and hung in a hall or den, they become an interesting feature.

Pictures are generally hung at eye level except when used to form a unit with a low piece of furniture such as a chest or desk where the grouping may appear more balanced if they are hung slightly lower.

When wall hooks are used both the hook and the cord should be concealed behind the picture. If pictures are hung from a railing, two wires or cords should be used so that they form two parallel lines rather than an inverted V.

Mirrors also look better if they are fitted to the wall instead of being hung from a chain. If strategically placed, they can make a room appear wider or longer or they can reflect an interesting decoration or a view. Like

[*Green and Hahn*

This massive picture tends to dwarf the light, period furniture.

▼ The correct (right) and wrong (left) ways to hang a picture. A picture should be hung with the cord and hook concealed.

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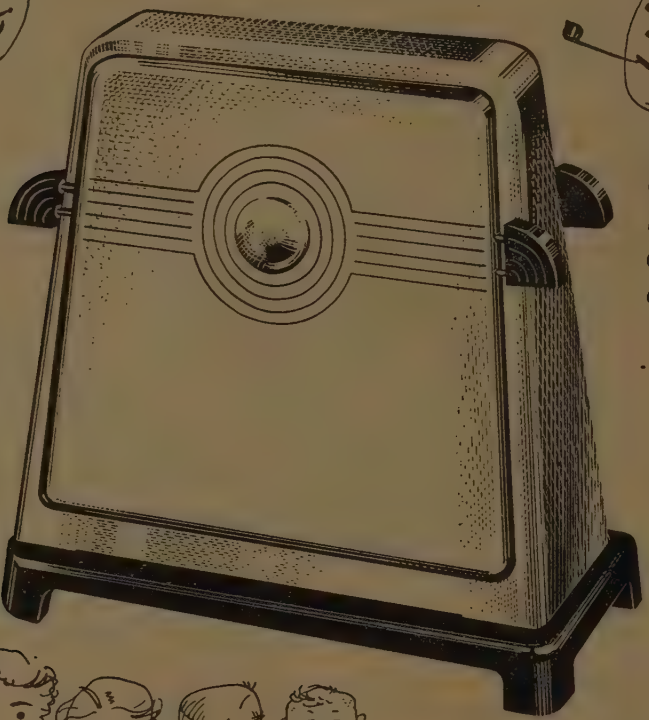

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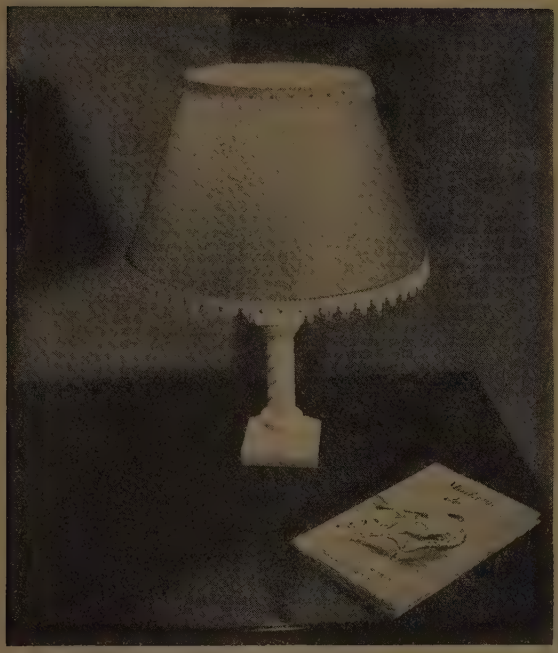

▲ Combining beauty and usefulness, this teapot is an example of excellent design.

← The appearance and efficiency of this lamp are spoilt because the shade is too large and the base too short.

pictures, they should be large enough for the intended space and if hung above a mantelpiece, they should be about two-thirds of its length.

Picture-mirrors are of no artistic or utilitarian value and should be avoided.

Reading Lamps

Reading lamps are among those accessories which have a function as well as a decorative value. Their first purpose is to give good light, but when well chosen they also create areas of colour and warmth.

When a lamp is chosen the first consideration is where it will be used; this determines the necessary height. The base of the lamp should be high enough to direct the light where it is required and solid enough for it to stand firmly. A lamp with a short, stumpy base will throw a very limited circle of light, so it is of little use other than perhaps on a hall table.

Lamps of simple design with plain fittings and tailored shades are always in good taste and will give more lasting satisfaction than those with over-decorated bases and fancy shades.

The shade should be deep enough to prevent line-of-vision glare from the bulb and for appearance sake be in good proportion to the base.

The choice of material and colour depends on the furnishing scheme of the room and usually a white shade will look effective against dark walls, and red or green will provide a pleasant accent against light-coloured walls.

However, different colours reflect light in different degrees, so when shades other than white or yellow are chosen the lining should be light to give better reflection. They should be tested both in daylight and at night to make sure they do not adversely affect the colours in the room.

Flower Arrangements

Flower arrangements are a favourite means of adding beauty and colour to a room and here again the rule of proportion should be applied. Both the size of the container and the height and width of the arrangement should be appropriate to the setting. Flowers look their best against a plain background and their colouring should harmonise with this and with other colours in the room.

Interesting effects can be achieved with healthy growing plants or green

The plain undecorated container is the best for displaying flowers.

[*Green and Hahn*

A pipe rack used effectively to display a collection of miniature china.

foliage and, if skilfully created, with driftwood or dried arrangements. The latter, though, can lend an air of dejection if the colouring has been lost and they are left to gather dust.

Floral art has become a subject of interest to many women and its study has led to an appreciation of beautiful lines and clever grouping of colours. Where formerly flowers were just massed into vases they are now grouped into arrangements of artistic merit.

One of the essentials for successful floral decoration lies in the choice of proper containers. Their functions are to hold water and to show off the flowers to best advantage. Today simple containers suitable both in colour and texture for the flowers they are to hold have replaced ornamented vases which detract from the flowers themselves.

Cushions

Cushions are another example of accessories with a purpose; they are useful for comfort and add bright accents of colour to sofas or chairs. As a general rule if the upholstery is patterned, plain fabrics will be the best choice for the cushion covers. When the upholstery is solid coloured, a patterned fabric may be used, but in either case tailored-style cushions are invariably in better taste than over-fancy ones.

The modern trend is to group several cushions together; they may be in different colours, but always blending with the general decorative scheme. The fabric used should suit the type of room. In a formal 18th century room cushion covers of brocade and velvet will be in keeping, but solid-coloured cottons and textured weaves are better suited to a contemporary room.

Minor Accessories

Books might be included in this category, not just stiffly-bound volumes, but books in gay covers on open shelves, as they add greatly to a homely, lived-in atmosphere and have a definite use in the decorative scheme.

Shelves can be used effectively to display collections of various kinds. Light-coloured china is shown to advantage in shelves or alcoves which have their interiors painted in a rich shade, and blue, green, or other coloured pieces look well against a white or pastel surface. Grouping such a collection gives better results than a scattered effect.

Decorative figures, ashtrays, boxes, candlesticks, and plaques are further possibilities, but they should be used with restraint and discretion.

An accessory can be tested as to whether it will improve the appearance of a room by a few simple questions:

Is it pleasing to the eye and touch?

Is it well made?

Is it appropriate to the style of the room?

Are the colour, shape, and proportion right?

Is it useful?

The final requirement for success is imagination. Trite, conventional arrangements can be extremely dull, but something with an original touch will transform an undistinguished room into one with individuality.

There is a tendency to grow so accustomed to one's surroundings that the critical sense is lost. The saying that "changes are lightsome" could well be applied to the use of accessories and a periodic review with a new approach would produce surprisingly refreshing results.

Planting and Training Ornamental Plants

ADEQUATE soil preparation, coupled with careful and correctly timed planting, is important for the successful establishment of plants. After care, which includes thinning of shoots, pruning to shape, and where necessary support for the plants, is, however, of equal significance for their development. In this article K. H. Marcussen, Horticulturist, Department of Agriculture, Christchurch, outlines the points to be considered in these operations. The notes on garden work for July are by Rosalie A. Campion, Horticultural Instructor, Department of Agriculture, Wellington.

PLANTS cannot be expected to grow their best without a good start. They must be planted in good and well prepared soil in a suitable position, according to their climatic requirements, and cared for during the "baby" and "adolescent" stages. This period will vary from a few months for short-lived plants such as annuals to a number of years for large trees.

Soil Preparation

It cannot be stressed too often that the soil should be well prepared before planting. For short-term plants adequate plant food in the form of fertilisers should be incorporated, but for trees and shrubs the loosening and opening up of the soil is perhaps the most important consideration.

All soil preparations, but particularly when done deeply, should be made well ahead of planting to enable the soil to settle naturally; otherwise the correct level for planting is difficult to determine, and especially on heavy soils is that important.

For deep preparation the top spit of soil should be removed while the second spit is broken up. If the soil is heavy, it is of advantage to incorporate bulky organic material in the lower spit, as it will then be prevented from compacting later on; suitable materials would be stack bottom or half-rotted compost.

This loosening of the subsoil will not only assist deep-rooting plants to become established, but it will also provide better drainage and aeration.

One warning must, however, be given. Sometimes a deep pit is dug out and filled up with good soil before a tree is planted. If this is done in clay, the soil water tends to collect in the pit, probably resulting in killing the tree.

Where such danger exists drainage from the bottom of the pit should be improved or provided.

For surface-rooted plants, which will benefit from the stimulus of a fertiliser dressing, a suitable mixture, which can be applied at 4 oz. per square yard, consists of:

Blood and bone	3 lb.
Superphosphate	1 lb.
Sulphate of potash	1 lb.

Preparation of Plants

Deciduous plants of normal planting size require little preparation before planting, but plants in foliage should be prepared beforehand.

Generally for annuals and other herbaceous plants all that is necessary is a thorough watering some hours previously so that the plants are in the best condition to meet the shock which invariably results from the damage to the roots. An additional preparatory treatment termed wrenching is, however, desirable for woody evergreen plants.

Wrenching is a type of root pruning which should be done in late summer if the plants are to be transplanted during winter. It is done by pressing a sharp spade fully into the ground at an angle so that all the roots will be cut, including those directly underneath. The position of these cuts will vary with the size of plant, but should

Heading photograph by Sparrow.

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▲ Effect of wrenching shown by the development of numerous new roots.

When a tree is planted in a large hole the soil level can be judged by spanning the hole with a rod or rake handle. The old soil level can easily be seen on the plant. Green and Hahn photo. →

▼ Seedling gums which have been cut out from boxes with little disturbance to the roots.

seldom be less than about 6 in. from the centre of the plant.

After this wrenching the plants should be firmed by tramping carefully round them and kept adequately watered to prevent their wilting. The cutting of the roots will promote a denser root system and the new roots, which will be formed from the cut ones, will assist the plants in establishing themselves after transplanting (see the illustration at left).

Seedling trees growing in boxes should be treated in a similar way, but the operation is then simplified, as wrenching can be done by a sharp knife being run between the rows of plants in both directions so that the soil round each plant is cut into a square. If this is done several times, the last time a week or two before planting out, the trees will suffer very little from the shift (see the illustration at left below).

This treatment will assist the plant to absorb moisture and is preferable to standing the roots in water for several days, which may kill the plants.

The time for planting must be governed by climatic conditions; autumn or early winter planting is preferable for most trees and shrubs, especially in districts with a dry spring, as the plants may establish during winter; but frost-tender subjects are usually better planted in spring, when normally the hardest frosts are finished. Some spring flowering evergreens, especially rhododendrons, are best shifted in spring when in flower, but that is rather exceptional.

If evergreen conifers are shifted late in the season or have not been adequately prepared beforehand by wrenching, they can be sprayed with a solution of venyl resin (available in New Zealand as S.600). This material forms a plastic film over the needle or scale leaves, this reducing the loss of moisture through transpiration, thereby assisting the plants to establish in the new positions.

Planting

Planting is not a major operation, provided the soil has been well prepared beforehand.

The soil should be moist, but not so wet that it will clog on footwear and tools. This may, of course, be so when woody or herbaceous plants arrive from a nursery in winter, but then it is better to leave them rather than attempt to plant when soil conditions are unsatisfactory. Plants should, however, not be left long out of the ground and they should be heeled in in a position where the soil is drier, such as under trees or in the shelter of a hedge or building.

Heeling in consists of laying the plants at an angle, with the roots spread out in a shallow trench and covered with soil, which should be firmed lightly.

Sometimes deciduous plants arrive very dry and the top growth may even be shrivelled. It is then wise to bury the whole plant in moist but not wet soil for a few days or even a week.

Evergreen plants are usually sold in a clump of soil covered with hessian, or sometimes polythene sheeting. Home gardeners often wonder how to deal with these plants. Should the soil and the covering be removed or should the plants be put in as received from the nursery or shop? The first consideration when a balled plant is obtained is to check the moisture content of the clump; it can generally be judged by its weight, as a dry soil is light. If it appears to be dry, soak it for a short while in a bucket or tub and do not plant it for a day or two.

Plants should never be stored in a shed, as this may soften them; they should be placed in a sheltered position outside or, better still, heeled in.

When the soil of a balled plant is suitably moist and ready for planting, the strings holding the covering should

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Life would be a good deal easier if everything happened in orderly stages . . . if lambs arrived all the year round . . . if apples ripened each month of the twelve. . .

But Nature doesn't work that way. If your business is, like most of New Zealand's, concerned with primary products, you have your peak periods, times of tremendous activity when your produce gathers for shipment.

So, after *your* peak period, then follows ours; for, at such times, a torrent of produce descends upon the Railway and Harbour Authorities. The season is in full swing and dairy produce, meat, fruit, wool and other general cargo are all piling up for immediate shipment. The cargo must be moved or markets will be missed. And yet together these cargoes far exceed the carrying capacity of the ships normally arriving with imports. They exceed also the capacity of the railways to move them and the ports to handle them.

On such occasions, then, the task is to get a quart into a pint pot—which (as everyone with any experience of pints and pots will tell you) is impossible. So what happens? The railways and ports work at full stretch, and up to the limit of their capacity we provide the ships.

This is not as easy as it sounds. It may mean that ships must be sent to New Zealand partly or even wholly in ballast. It may mean chartering additional tonnage; if, for example, your need is for extra refrigerated space at a time when the only suitable vessels are loading general cargo for you in the United Kingdom, those cargoes must be transferred to other vessels so that the refrigerated ships can be sent—empty, if need be—to load New Zealand meat. And, if no ships of the New Zealand Lines are available to handle the displaced cargoes, tonnage must be chartered from elsewhere.

All these are expensive operations. But, more to the point, they are complex operations involving more than one shipping company. Yet year by year, they are carried out without fuss and without publicity.

And, after all this movement and planning and co-ordination have we got our quart into the pint pot? We have not. But, with the help of the Railway and Port Authorities, together with the Watersiders, we have come much closer to it than anyone would have thought possible.

And if, at the end, there is still cargo unmoved, it will not be there for long. *There will very soon be another ship.*

Issued in the interests of mutual understanding by

NEW ZEALAND OVERSEAS SHIPPING LINES

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be removed. A polythene covering should always be removed, as that will not disintegrate, and if heavy sacking has been used, that, too, should be taken off. If open-textured hessian has been used and numerous new roots are growing through, there may be some justification in leaving it on the plant.

It is, however, best to remove the covering so that the soil and the roots can be examined. When plants are balled in a nursery the soil remaining on the roots may not be sufficient and other soil is often added. Occasionally, when a plant is examined this added soil is found to be stiff clay, which of course should be removed before planting, but if a good soil or compost has been used it can safely be left. It also often happens that some of the roots have been bent or twisted into the shape of the ball to get it into a manageable size; such bent roots should be straightened out during planting.

Plants from pots should be examined and treated likewise, as it is not uncommon, especially on pot-grown trees, that the larger roots are found to be looped round inside the pot. Half-grown wattles and gums are sometimes blown over in a gale as a result of strangulation by roots which have been looped in a pot and never straightened out.

For the actual planting, a hole slightly larger than appears necessary should be made. The plant should be placed about the same depth or just a little deeper than it was before; this level can easily be seen on examination (see middle illustration on page 613). The roots should be well spread out and any damaged ones cut back cleanly, preferably to a side root. Fine soil should then be worked in between the roots and when all the roots are well covered it should be firmed. Care should be exercised at all times to ensure that the roots are not damaged; the usual recommendation of heavy tramping is sound, provided it is done carefully (see illustration at right below).

If the soil or conditions generally are dry, watering should be done as part of the planting operations. This is of course more important when dealing with evergreens, but in an occasionally exceptionally dry season it would be advisable to water deciduous plants also.

Bedding plants generally require to be watered in after planting.

After Care

Attention is required after planting. Supplying of moisture is of course of major importance until new roots have formed and water must be supplied according to the weather.

Syringing or overhead watering is beneficial for evergreen plants of whatever size or kind if the weather is dry.

Some plants require staking because the main stem is too slender or soft to take the strain of wind or the weight of the top growth, but others for which staking has not been considered necessary should be checked from time to time, especially when the weather has been wet and windy. A cone-shaped hole forming at the base of unstaked trees which have been blown about while the ground was wet can commonly be seen. Such holes should be filled in and well firmed; it may even be advisable to stake the trees to prevent a recurrence.

Shrubby plants in windswept areas can be kept in position by placing a few rocks at their base. Not only will the roots be anchored, but the rocks will keep the soil cool and will also prevent loss of moisture.

Finally, some pruning and training may be required to develop the desired shape or habit of the plant; that will be dealt with in a separate section.

Staking of Plants

Plants which require staking should be attended to at an early stage, not

It is better to plant dahlias after the stakes have been put in.

Firming of the soil round the roots after planting is essential, but should be done carefully. Elliott photo.

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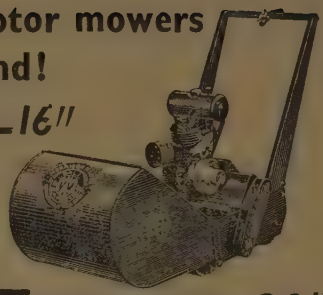

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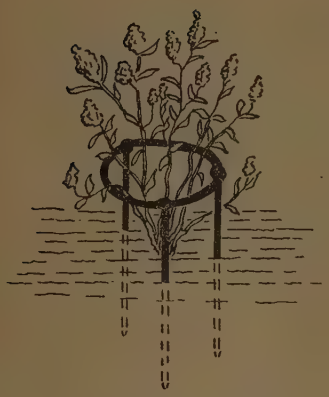


Wire support for medium-sized herbaceous plants.

after they have been blown over and damaged.

Stakes should be strong and durable. Metal pipes are satisfactory and also hardwood or totara, but pine stakes will seldom last longer than one season. Cane stakes are ideal for temporary supports, such as are required for herbaceous plants. Because of their thinness they do not provide a secure anchor even when driven well into the ground, and a stouter stake is preferable. Furthermore, canes do not last if left in the ground and would be liable to snap during a storm.

Stakes should not be of such dimensions that they are conspicuous. They should be solid enough to give the required support, but they should be screened by the plant as much as possible.

The stake for a tree should be perpendicular; otherwise it will attract attention. For plants of bushy habit, such as herbaceous perennials, chrysanthemums, and dahlias, the stake should be perpendicular if only one is used, but if several are used round the plant, they can be put in pointing slightly outward. If light stakes are used in this manner, the straining in tying the plants may draw them in at the top and it is an advantage to have the extra space to allow for a slight bend in the stake.

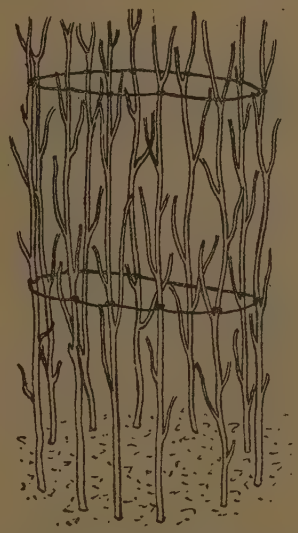
Sufficient length of stake should be allowed for any individual plant. When the plant is fully grown the stake should not come within about 6 to 9 in. of the top. If excessively long stakes are used, they tend to attract attention away from the plants they are supporting.

It is sometimes better to put the stake in before planting is done. If that is done for dahlias, the tubers will not be damaged by the stake; furthermore the stake will show where the plant is until it grows larger, as well as providing a place for fixing the name tag (see left illustration on page 615).

When a row of standard roses is to be planted the stakes should be put in first. It is then much easier to place them in a straight row, perpendicular, and at the same height, points which will make all the difference to appearances later.

When standard roses are planted they should be placed so that the head of the rose is a fraction clear of the top of the stake.

When a firm tie is made the rose will be held securely without danger of its snapping off, and it will look much better than if the stake protrudes beyond the branches.



Manuka sticks, looped together with twine, for training sweet peas in clumps.

Stakes should always be driven deep enough to reach firm ground; this may mean an additional 12 to 15 in. more than is required above the ground.

Expensive wooden stakes should be bevelled at the top to prevent their splitting or a corner chipping off, which can easily happen, especially if a hammer is used. If available, a mallet should always be used.

Other Supports

Apart from stakes there are other means of supporting plants. Wire gadgets have been developed and some are excellent for smaller subjects; perhaps they are used more for carnations than for any other plants (see the illustration at upper left).

Sweet peas are particularly useful for giving height to a border. Sometimes they are used for covering old tree stumps and can then be trained on strings fixed to the top of the stump. If they are wanted in the open, a tripod made of branches will provide suitable support or a larger fixture (see middle illustration on this page) can be used.

Some climbing plants are self-supporting, but others must be tied. With trellis tying is easy, but on corrugated iron or paling fences it can be a problem. For such fences the job would be simplified if horizontal wires were fitted. The wires should be kept a little away from the fence and battens could be provided on the "face" side for that purpose. Such battens (2 in. x 2 in.) could be nailed through the boards or iron to the posts and the wires attached to them. A couple of inches between the plants and the fence will allow air to circulate and climbers will not be so subject to fungous diseases; this is particularly important when roses are grown.

Tying

Tying done efficiently is a never ending job.

Fast-growing herbaceous plants should be given additional ties as they grow; otherwise they are liable to bend over. If any stems are left in a horizontal position, even for a day, the succulent tips will probably turn vertical; once that has happened straightening the plant is very difficult (see illustration below).

For slow-growing plants and for permanent ties as on standard roses, lasting materials such as fencing wire or electric cable are sometimes used. These may appear satisfactory, but apart from strangling or cutting into the growth as the plant grows, such ties offer a home for insect pests, par-

Wire rings are a quick and satisfactory method of holding light growth in position.

Left—Tying standard rose with discarded nylon stocking: A—Stake and stem. B—Several turns round stem and stake with stocking. C—Between stake and stem below tie. D—Return above. E—Pulled tight and knotted. Right—Various kinds of padding under ties on trees. Note the firming of the tie between tree and stake; this will prevent rubbing.

ticularly in warm districts where scale insects are prevalent.

All ties should therefore be renewed every year, even if they appear satisfactory.

Tying material should be durable and preferably soft textured. Raffia, sack twine, and binder twine are satisfactory for short-term support. Binder twine is durable enough to last a year, but adequate padding should be used if a tight tie is made, as it may gradually cut into the tissues otherwise. Rubber, leather, and canvas strips are materials commonly used, and again, padding should be used.

For home gardens, where generally only a limited number of ties are required annually, apart from those for which binder twine can be used, discarded nylon stockings are excellent. They are durable, soft, and have enough elasticity to obviate padding; furthermore, they are fairly neutral in colour.

Padding can be provided by any material which will prevent the tie cutting into the bark. Strips of sacking are often used for small ties, but where a moderate to strong strain is applied wooden blocks are the best material. When such blocks or slats are placed upright along the stem the pressure will be placed on a greater area and damage will very seldom occur provided the tie is renewed, and if possible moved, a little every year.

The illustrations give further details of tying and padding (see illustrations above).

Training

The training of ornamental plants consists of developing the shape required for a particular position or the promotion of a required number of flower stems and flowers.

Many plants are "stopped" to make them bushy. An example of a flowering plant for which this treatment is recommended is a chrysanthemum the growing point of which is pinched out to induce bushiness and to develop a number of stems low down on the plant; on some varieties it may be done a second time before the flowering stems are allowed to develop. This results in the plant being shorter and consequently more desirable as a garden plant and not so subject to wind damage. Furthermore, some of the branches developing after the stopping may be removed so that a reduced number of flowers but of better quality will be grown. To continue with chrysanthemums, when a suitable bud has been selected for each stem all the other buds are removed to ensure that the selected one will grow as large as possible; this is called disbudding.

Some bedding plants such as stocks and antirrhinums are usually stopped to develop branching and many plants used for both indoor decoration and general nursery stock are stopped to develop more branches. Most flowers grown for show purposes are disbudded.

When a hedge has been planted it is essential that it be cut fairly hard back to encourage side growth low on the plants. If the hedge is not developed at that stage, it will seldom be possible to make it close at the bottom. Likewise if a close hedge is desired, it must be trimmed regularly; each time it is trimmed more branches will be formed, resulting in a denser hedge.

On the other hand some plants are required to be grown as standards or at least as non-branching trees to a certain height. Trees which normally are propagated by budding or grafting are sometimes put on a tall stock at the required height for branching (standard roses, flowering cherries, and weeping elms), but those raised from seed or cuttings are trained on a single stem until the required height has been reached and branching is encouraged.

Standard fuchsias, geraniums, and heliotropes are developed on one stem and once the required height is reached the head is formed by frequently stopping all the shoots to facilitate branching. Most deciduous trees can be regulated if the leading shoot is let grow to a certain height before branching is either allowed or promoted by stopping.

A single stem can be developed in two ways. The quickest method is to prevent all side shoots from growing by rubbing them out as soon as buds have formed and keeping the leading shoot well staked. By this method a rather weak stem will be formed. If,

Properly trained roses look attractive when dormant and will produce a wealth of flowers.

however, the side shoots are allowed to form and are stopped after a few leaves have developed, a stouter stem will result, though it will not grow as quickly.

Some flowering plants, for example, oleanders, may not continue growing a single shoot, but run into flower and these produce several shoots at the base of the flower stem. The strongest one of these can be tied in and the others removed. The bend which will eventuate will be temporary only; after a year or two it will have disappeared.

Formation of a straight trunk of sufficient height is not the only consideration in the training of trees. The type of head to be formed must be considered. Should there be one leading shoot making the trunk of the tree, or is it more suitable to have a number of leading branches? The type of tree and its position in the garden will decide that and pruning in the early stage will decide the future development.

For a branched tree the leading shoots should be stopped and it is generally better to make a cut well back so that several branches will break away evenly. Their strength and balance can be adjusted by careful pruning.

Sometimes two or more shoots will form instead of one leading shoot. If a single trunk is desired, this should be secured by cutting out all others. Pruning for the development of a tree should be done at an early stage of its growth. The cuts will soon heal over and will not disfigure or weaken the tree as they might if the same branches were removed later.

To grow most flowers on any one branch climbing roses should be trained as horizontally as possible. If they are left growing upright, the flowers will form mainly from the top, but a rose which has been spread out as shown in the illustration on page 618 not only looks attractive while it is dormant, but will produce a wealth of flowers.

Work for July

Though for much of July the soil will be too wet for cultivation, time should be taken to clean up neglected corners, prune shrubby plants, and check on pests and diseases.

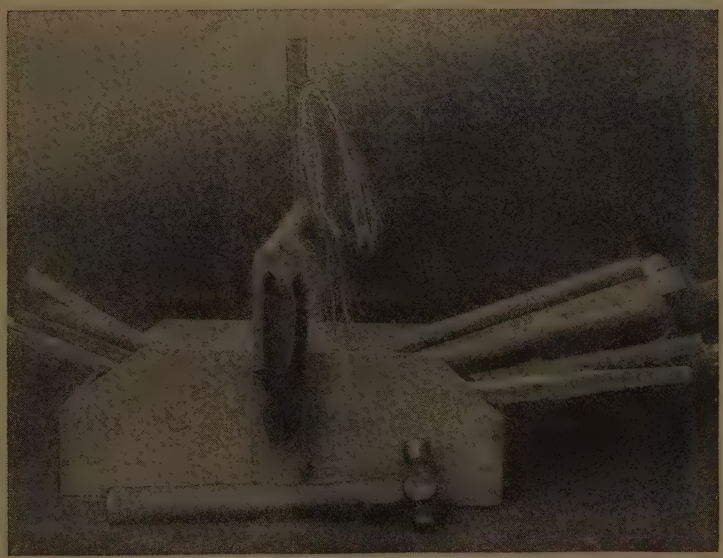
Cleaning up

A container or place for burning diseased and woody plant material and other garden or household refuse not fit for composting is essential in a garden. To make an incinerator from an old fuel drum remove the top and bottom, insert iron standards or pipes about 1 ft. from one end, and cut out an air vent between these and the bottom. A concrete burning place alongside the compost bins makes a compact unit for disposal of garden refuse of all types. By the quick disposal of such material ground cover for pests is reduced.

Where slaters abound DDT should be dusted liberally on the infested areas. If the hiding places of slaters are not evident, plants can be protected by poison bait broadcast round the plants at 1 oz. per square yard. Suitable baits are a mixture of 1 oz. of paris green or lead arsenate with 4 lb. of dried blood.

Left—Tins with tops and bottoms removed make good shelter for young plants and the flowers of *Helleborus nigra*. Right—Drums can be made into incinerators by an opening being cut from which to remove ashes and by iron bars or pipes being fitted across the drum.

If slugs or snails are troublesome, sawdust can be spread round the plants as a deterrent or metaldehyde baits can be used. Two of their favourite plants which should be protected are *Iris ungicularis* and the winter roses *Helleborus nigra*. The baits can be made from 1 oz. of crushed metaldehyde mixed with 3 lb. of moistened bran or breadcrumbs. These baits are poisonous and should not be left lying about where children can pick them up.



During winter this handy garden carry-all can be easily made.

GARDEN WORK FOR JULY . . .

Use of Ashes and Soot

Garden ashes should be stored in a dry place for spring application to the garden. Most garden ashes contain a small amount of potash salts which are very soluble; if they are applied to the ground now, the salts will be washed out of the soil before the plants can use them during the growth period. They should not be left uncovered, because the rain will wash the nutrient out of them. Wood ashes should be spread thinly over the soil and worked in when the soil is dry. Too thick a covering of ash is sticky to work with when wet. A high percentage of calcium is usually present in wood ashes and for this reason they should never be applied round rhododendrons and azaleas. They have been known to cause the death of such plants.

Soot contains a small quantity of nitrogen and if available, it can be useful if applied round plants. It can also be used with water as a liquid fertiliser for plants growing in pots or tubs to encourage faster growth and greener leaves.

Sharpening the Lawnmower

A hand-driven lawnmower should be sharpened regularly and with precision. The more complicated structure of some mowers and poor previous treatment may necessitate their being sharpened by an expert, because poorly set mowers can damage both the lawn and the cutting blade.

Gardeners wishing to do so, however, can sharpen their own mowers. All dirt and clippings consolidated on the blade and bottom cutting plate should be removed. The pawls and drive gear inside the wheel should be changed from one driving wheel to the other. This enables the cutting cylinder to be driven in reverse when the mower is pushed in an upside-down position. The bottom plate should then be raised evenly by adjusting the bolts until it firmly touches the cylinder blades. A mixture of powdered carborundum and heavy oil should be smeared along the bottom plate and the mower then pushed round upside-down. When the cylinder blade edges are sharp all traces of the carborundum-heavy oil mixture should be removed and the cylinder reset in the normal position. The bottom plate should be raised or lowered each end until a tissue paper can be cut cleanly between the blades over the whole length of the plate. The task should be completed by the oiling and greasing of every part.

Lawns should not be allowed to get too long at this season or the finer grasses will be killed by the shade. The mower can be adjusted to a high setting by lowering of the roller and frequent light mowings can be given.

Roses

Where soil conditions allow, roses can be planted until the end of July in cooler districts. In the warmer northern districts planting should be completed without delay.

All rose bushes should be pruned during July in warmer districts, but in southern districts pruning should be delayed until August so that new growth will be delayed until the main frost danger is over.

The first step in pruning roses is the removal of all dead and diseased wood. Where bush roses made plenty of new growth last season old flowering branches should be removed cleanly at the base of the bush. If little new basal growth has been made, weak and spindly growths should be removed from old branches and strong flowering growths should be pruned back to within 6 in. of the old wood. Matured new basal growths should be pruned to about half their height and immature growths should be lightly pruned by the removal of the seed heads. Where possible the bushes should be opened up to give light and air to the growths and any badly crossed branches should be removed. The new grandiflora roses such as Queen Elizabeth make very strong growth and by pruning at different heights can be used as bush roses or pillar roses.

Climbing roses, except those of the rambler type which should have been pruned after flowering, can be pruned now by removal of old growths to encourage strong young growths. Where old growths must be retained, the shoots which have flowered should be be pruned down to two buds from the main branch.

All prunings and fallen leaves should be burnt and where scale insects are present oil sprays should be applied. If bushes are completely dormant, 1 pint 12 fl. oz. of winter oil in 4 gallons of water should be used, but if growth has already begun, summer oil at 8 oz. to 4 gallons of water should be used instead. Where trouble is experienced in controlling powdery mildew a sulphur spray of 3 fl. oz. of lime sulphur plus 1¼ oz. of colloidal sulphur to 4 gallons of water should be given after pruning.

Iceland Poppies

Where a sheltered and well drained position is available Iceland poppies will provide over a long period a crop of flowers which is especially valuable for picking. The two main diseases which affect these plants are verticillium wilt fungus and tomato spotted wilt virus. In poppies and a wide range of other garden plants including stocks, gerberas, and irises verticillium wilt causes gradual wilting, stunting, and often death. It is a fungus which is carried over in the soil from year to year and can be spread to clean ground in infected soil adhering to seedlings and tools. Where this disease has occurred the plants should be burnt and the soil partially sterilised by the addition of 4 oz. of copper oxychloride per square yard applied either as a powder or in water, or formalin at ½ pint to 3 gallons of water per square yard. When formalin is used the ground should be covered with sacks for 2 days after application and can be dug and replanted after 2 weeks.

Tomato Spotted Wilt Virus

Iceland poppies, anemones, cinerarias, and primulas are some of the winter hosts of tomato spotted wilt virus. This virus is not carried over in the seed, but is transferred from plant to plant by thrips. All diseased plants and host weeds should be burnt. Among the common weeds which are hosts to this virus are buttercup, capeweed, black nightshade, and henbane.

The leaves of Iceland poppies first become pale, develop purple streaks along the veins, and may have short leaf stalks. As the leaves themselves are small, the plant appears bunched at the crown. The purple streaks enlarge to cover large portions of the leaves, and with the wilting of the foliage the plants collapse.

Pronounced distortion and curling of the leaves, shortening of the leaf stalk, and severe stunting are seen on anemones which have been infected. As well as the stunting effect cinerarias and calendulas usually show mosaic mottling; primulas show a pale colouring (chlorosis) and the development of dark streaks or dead areas on the leaves.

Scale Insects

Some scale insects increase so rapidly that often they are not noticed until affected plants become visibly depressed. This is first seen as a yellowing of the leaves and lack of new growth. A check should be made to see if any of the following hosts are harbouring these pests.

San Jose scale: A wide range, including wattle, privet, poplar, stone fruits, roses, ash, and elm.

Brown scale: Roses, ornamental grapevines, broom, wisteria, and eleagnus.

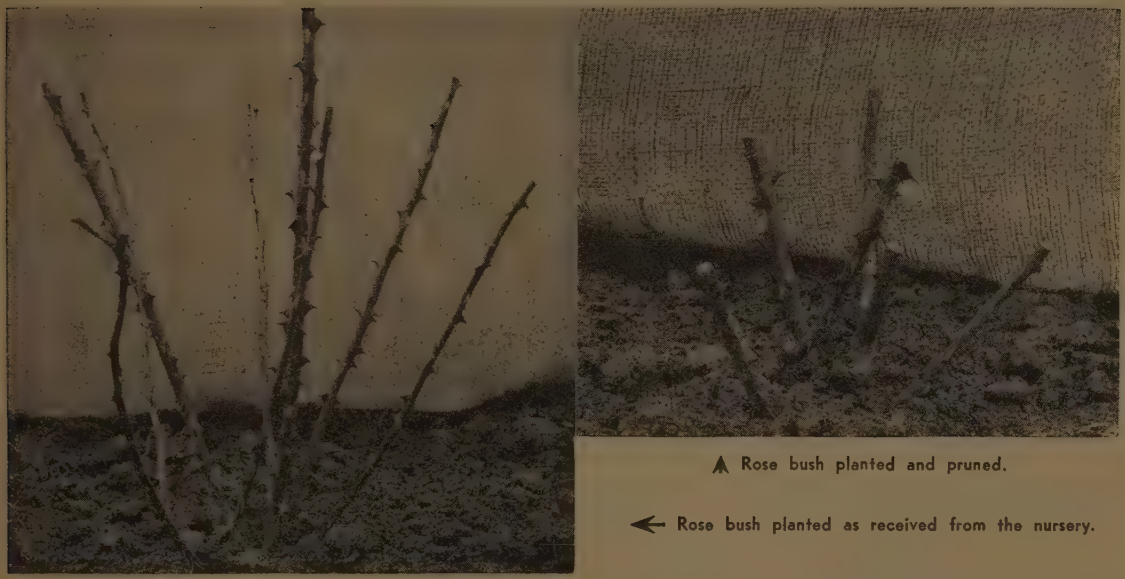
Rose scale: Roses.

Golden oak scale: Oaks.

Scales can generally be controlled on deciduous plants by spraying them while they are still dormant with winter oil at 1 pint 12 fl. oz. to 4 gallons of water. Evergreen plants should be sprayed with summer oil at 8 fl. oz. to 4 gallons.

Glasshouse Management

In glasshouses attention should be given to watering, heating, and ventilation. On most mornings the ventilators should be opened slightly by 10 o'clock to avoid a build-up of temperature and to allow a change of air. By mid-afternoon they should be closed down again to trap the heat



▲ Rose bush planted and pruned.

← Rose bush planted as received from the nursery.

within the house over the cooler nights. If heating is used, the atmosphere should not be allowed to become dry. This can be avoided by damping down under the benches morning and night and, on very warm days, at midday also.

Care should be taken to avoid overwatering pot plants. Flower heads on cyclamen, cinerarias, and primulas should be removed as soon as they are past their best, and regular liquid feeding will assist to prolong the flowering. A watch should be kept for the build-up of greenfly, especially on calceolarias, pelargoniums, and potted hydrangeas. Malathion, nicotine sulphate, or lindane should be used when necessary to control this pest.

Bulbs in pots or pans should be watered sparingly until the flower buds appear; the amount of water can then be increased. If watering is heavy before the flower bud appears, the leaves tend to be large and are likely to obscure the flower.

Propagation under Glass

Cuttings of perpetual flowering carnations may now be taken and rooted in a sandy medium. Rooting hormones will hasten the development of roots.

Seed of the slower-growing bedding plants can be sown in prepared compost in boxes. These include *Verbena venosa*, *Begonia semperflorens*, gaillardias, antirrhinums, pansies, calendula, lobelia, and petunias, which can be pricked out in August-September and planted in October to flower by Christmas.

Seed of greenhouse plants such as gloxinias, streptocarpus, cyclamen, and tuberous begonias can be sown now in light compost and given a very shallow covering of the same material.

In cold frames where half-hardy bedding plants such as geraniums are being wintered the lights can be opened up on fine days. When the weather is unfavourable they should be raised only slightly to give ventilation. Where frosts are experienced it is advisable to cover the frames at night with sacking, which should not be removed until the sun has warmed the atmosphere. This gives the plants time to thaw out gradually. A check should be kept for the development of geranium rust, and sulphur or zineb sprays applied immediately it appears.

Where early chrysanthemum cuttings are required the old stools can be dug and placed in sawdust or soil in the frame to encourage new growths.

General

When soil conditions are suitable beds of annuals for spring flowering should be lightly forked to aerate the soil and remove weeds. Where bulbs have been interplanted care should be taken to avoid damage to their shoots.

Compost heaps can be turned and material can be sieved in preparation for use in spring seed sowing. Coarse material should be returned to the compost heap for further decomposition.

Preparation and levelling for spring sowing of lawns can be continued where soil conditions permit. If the drainage needs checking, a hole should be dug and left open so that the winter water level can be observed. Few plants can thrive if their roots are waterlogged for long, and it may be necessary to install some type of drainage.

On shrubs which flower on the current season's wood the shoots which grew and flowered last season should be cut back to within a few inches of older stems to ensure a constant supply of flowering wood and prevent the bush from becoming straggly.

Sweet peas can still be sown in boxes or cold frames for spring planting and plants from seed sown earlier can be hardened off and planted out in milder districts. Annuals sown in the border can be thinned out to 9 in. apart. In milder districts the planting of bedding material can continue.

In mildest areas young gladiolus cormlets which benefit from a long growing season can be planted 1½ in. deep and 2 in. apart.

The fibrous roots of *Iris kaempferi*, *I. siberica*, and the Louisiana hybrids can be divided and planted in a position which retains moisture over summer. Herbaceous plants such as helenium, rudbeckia, gaillardia, kniphofia, and lily-of-the-valley, as well as trees and shrubs, can be planted out where the soil is workable.

If shrubs have been closely planted, some thinning should be done so that the more desirable plants are not ruined by crowding and lack of light. Hedges of *Cupressus macrocarpa* and *C. lawsoniana* can be lightly trimmed.

Spray materials and equipment, fertilisers, and other sundries should be checked to see that ample supplies are on hand for the next growing season.

Weights and Measures in Cookery

ALL the recipes in the "Journal of Agriculture" contain standard measures and wherever practicable weights are used instead of measures. This should help to avoid errors, especially when new recipes are being tried. Nevertheless not only the newcomer to cookery may be surprised to learn that "a cup of flour" means not a large cup of flour scooped up from the bin but an 8 oz. cup of previously sifted flour, weighing 4 oz. The sifted flour is lightly piled into a measuring cup and the surplus is removed by levelling of the contents with the edge of a knife or a cooking spatula.

When dry ingredients are measured by the cup or spoon this technique of filling and levelling is always used. White flour is sifted before measuring, but brown flour is not. White sugar is stirred with a fork, but brown sugar is packed firmly into the spoon or cup.

Fat is measured either by being packed solidly into a measuring spoon and levelled with a knife or by being packed into a measuring cup. Fractions of a cup are measured very simply by use of water. For example, to measure ½ cup of butter a measuring cup is half filled with cold water and butter is added until the water reaches the top. The water is poured off and ½ cup of butter remains. Similarly to measure ¼ cup of lard a cup is three-quarters filled with water and small lumps of lard are then added until the water reaches the top.

Liquids are measured by filling of cups carefully to the measuring mark. To be accurate the mark should be seen at eye level.

Weighing

Old scales are very seldom accurate, and though the experienced cook may find that she can manage very well without weighing ingredients, the newcomer and the indifferent cook are recommended to use a good, modern weighing machine. The weights and scale pans should be kept clean (a plastic cover that can be slipped on when the scales are not in use is convenient) and if the machine has sliding weights on a rod, they should always be returned to the zero position after use.

If the scale pan is too small to hold the quantity of food to be weighed, a light basket or tray may be used instead. Remove the scale pan and when possible by using the sliding adjusting weight return the scale reading to zero. If this is not possible, note the weight of the basket or tray and subtract it from the final weight. If a spring balance is used, the pointer will spring back past the zero mark when its pan is removed, but the weight shown when the extra container is put on is the figure to remove from the final weight.

A standard measuring cup will hold 8 fl. oz.; 2½ cups equal 1 Imperial pint (20 fl. oz.).

Measuring spoons are made in sets containing a tablespoon, a teaspoon, ½ teaspoon, and ¼ teaspoon. Some sets have a ⅛ teaspoon, but this is not often needed. A little commonsense guesswork is usually able to supply the right answer for that amount.

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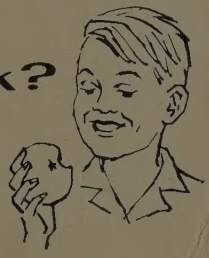
Destination .. dump or dimpled cheek?



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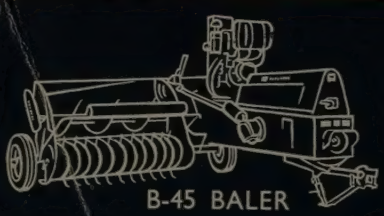

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